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VETERINARY MEDICINE

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Address of President, Indiana V. M. A.*

THIS has been a year of progress for the veterinary profession and for our Association. There have been many trials and problems, many of which we have surmounted, while a few remain and may raise their ugly heads at any time to disturb us and test our principles and judgment. We have a rich heritage behind us and a great future before us. We should profit by our mistakes and continue to strive for higher standards and assume a greater responsibility for service to the live stock industry and to the public health.

As an association we have kept strictly out of the political field, but in my opinion the time may not be far distant, when it may be desirable to cast our votes as veterinarians and forget partisan policies. We ask the cooperation of our membership in our legislative program.

Today, organization seems to be the policy of all groups in this country—the school teachers, the farmers, the manufacturers, the different branches of the medical profession, in fact one can hardly name any group, trade or profession that is not organized. I think we must have a larger representation of the veterinarians of this state in the Association with a better and closer working understanding between the members. To do this, we must have a goal to work toward and an increase in our membership. We must have a substantial majority of the veterinarians of Indiana as members, before we can say that our Association represents the veterinarians of the state. We must show those who are not members, by our efforts and program, that we are not striving for personal gain, and that becoming a member of and cooperating with the Association, may be the only means of maintaining their own practices, and the profession as a whole on the high plane where it now rests.

All types of business are concentrating on advertising, and even some of the professions but as an ethical group, we do not employ direct advertising. We can, however, use our public relation counselor to keep the public informed of what we stand for, of what we are doing in helping food conservation, and our part in promoting public health by protecting animals from diseases communicable from animals to man. During the last few months I have had reports from laymen in different parts of the state saying they had read more in the newspapers and heard more over the radio about veterinarians than ever before. This proves to me that our public relations department is functioning effectively. Our effiorts along this line should be intensified, since we have had this service just a short time.

I am proud of our young members, many of whom saw military service in the late war, for their interest in this Association and for the honest effort they are putting into their daily practices.

This country is now producing one-third more food, than it ever produced before the

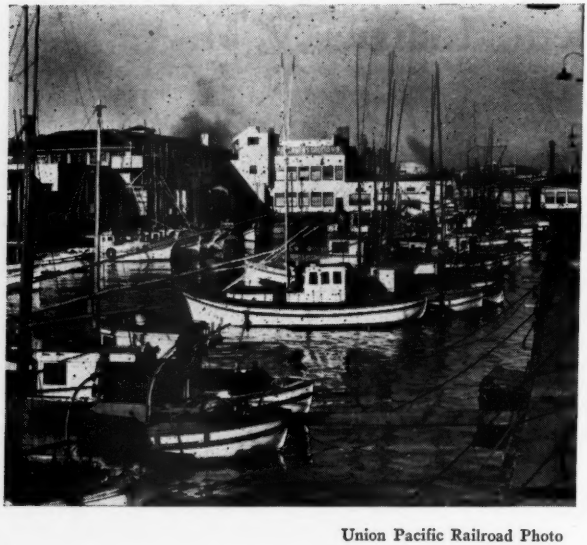
*Presented at the 64th annual meeting of the Indiana State Veterinary Medical Association, Indianapolis, January 15-17, 1948, by Dr. George L. Clark, Columbia City, President 1947-1948.

war, but even that is not enough. We are being asked to produce more and more. This increase can be achieved only by holding losses from animal disease at a minimum. This in turn requires a competent veterinary service, adequately manned. So we must, figuratively speaking, enlist in the service of our country. We must not only protect the livestock from disease but be able to advise our clients on their feeding problems. We should counsel the feeders on how to use their home-grown feeds to best advantage. This is not only an economical measure for the feeder, but it saves transportation facilities and costs. The function of commercial feed in a cereal producing area is to serve as a supplement for home grown grain and forage, that the latter may be used economically and to greatest advantage.

In visiting the local associations over the state I have found much interest and enthusiasm displayed. It should be a part of their program to enroll every veterinarian in their respective districts as a member. When a man becomes interested in his local organization, it is easier to interest him in the state organization.

There are opportunities opening before us in the field of public health. This we should not neglect as we have sometimes neglected opportunities in the past. It augurs well that one of our members has been appointed to a position on the Indiana State Board of Health.

The San Francisco Meeting of the A.V.M.A.—1948



There is no better port or harbor the world over than San Francisco Bay. To its wharves come ships from nearly every port on the seven seas. The illustration shows a section of the Fisherman's Wharf—small boats anchored at the dock after a day's haul. Restaurants alongside serve fish dishes famous wherever gourmet's congregate.

Union Pacific Railroad Photo

The scientific program of the 85th annual convention of the A.V.M.A., San Francisco, August 16 to 19, has been in preparation for weeks but at this writing is not ready for announcement, but entertainment and social feature planning is complete. San Francisco and environs offers much of interest to the most diverse tastes. To the usual attractions of the West Coast, which year after year attracts more tourists than any other section of the country, there is added this year the beginning of a three-year celebration of centennials—the centennial of the discovery of gold in 1848, of the Gold Rush in 1849 and of the admission of California to statehood in 1850..

To those historically inclined Coloma and Placerville, both in appropriately named El Dorado County, possess attractions. It was at the former that gold was first discovered in California, January 24, 1848, by James W. Marshall who was building a sawmill for Captain John A. Sutter, and changed the whole course of history on the Pacific Coast.

Placerville which succeeded Coloma as county seat of El Dorado County in 1857, was known in 1848 as Old Dry Diggins. In 1849 the name was changed to Hangtown, because several murderers were publicly hanged in main street. In 1854 it was incorporated as Placerville, at that time the third city in the state in voting population. One of Placerville's picturesque inheritances from the "days of gold" is the unique pattern of its streets. The "forty-niners" pitched their tents and built their shacks along the meandering gulches and small streams they worked for gold, thus laying the pattern for its streets, as cowpaths determined the location of many streets in Boston. Many interesting relics of the famous days of gold still exist in Placerville.

Fundamentals of X-ray Technic*

By ELIZABETH CLARK, M.D.**
Madison, Wisconsin

IT would be impossible to present the complete details of x-ray technic with all of the special procedures in one discussion. Therefore, I will try to give you (1) an outline of the minimum necessary equipment, (2) the general rules for taking radiographs, and (3) the esssentials of protection for yourselves, your clients, and for the animals to be x-rayed.

The first consideration is, of course, the kind of equipment. Three general types of machines are available: the portable machine, which is easily dissembled and can be used wherever there is a source of current; the mobile unit, which is self contained and mounted on wheels so that it can be pushed back into a corner or moved from room to room, and the stationary unit, which consists of a tube-stand mounted on a side rail, separate transformer and control stand and a table. The choice will depend upon the room available, the type of practice for which x-ray is to be used, and the expected return on the investment.

If large animals are to be x-rayed, or if the machine is to be used outside of the office, portable equipment is necessary. For small animal work, in the office or small hospital, a mobile unit is more practical. Such a machine will give satisfactory films, may be used for fluoroscopy, and if space is limited may be wheeled back out of the way when not in use. It has the added advantage, that it can be taken from room to room, so it may be used either in the operating room or in the examining room. Stationary equipment is practical, probably only in a larger hospital. It requires a good deal of space and is more expensive than the portable or mobile types. It has the advantages of increased penetration for heavy animals, and because of higher milliamperage ratings, the time for a given exposure is much shorter than with the smaller machines.

It is most important when buying equipment, particularly if second hand, to be sure that it is shock-proof. Almost all modern equipment is, but with the problem of restraint in veterinary radiology, protection from the possibility of electric shock is essential. Although dental units are shock-proof, they are too small to be practical for general small animal work, that is they lack the penetrating power. There are a number of excellent machines manufactured and aside from individual considerations, any one of them, in which the tube stand offers flexibility for positioning, should be satisfactory. It is preferable to buy the machine from a company which has readily available service, thus assuring prompt and reliable repair or replacement and also expert advice on installation and accessory equipment.

Source of current should be considered. Most portable and mobile units use 110 volt, 60-cycle current, but stationary units usually use 220 volts and a separate line transformer is preferable to prevent interference with other circuits and to assure full voltage to the x-ray unit. The tube should have as small a focal spot as is compatible with the use for which it is intended. However, good films can be obtained without expensive rotating anode tubes and stationary aquipment.

A good dark-room is essential. Films are more easily spoiled by errors in processing than in the actual x-ray exposure. If possible, this room should be equipped and used for nothing else. Developing in trays is possible, but is not as satisfactory as tank developing because the porcelain surfaces are easily chipped and the solutions become contaminated. A series of three tanks in a unit is available and, with an automatic mixing valve for hot and cold water to maintain constant temperature, is ideal. The dark-room must be light- and x-ray-proof and should be provided with red or amber safelights. The dark-room is usually a good place for film storage also, provided it is dry, X-ray film is much faster than photographic film and therefore more sensitive to light; thus precautions must be taken to protect it from fogging. The means used to dry films after processing will depend upon the volume of films. Commercial driers are probably not necessary except in a large hospital, but there should be adequate space to hang wet films so that they will not touch or stick together and also so that they will not drip on other films. Adequate ventilation in the dark-room will also facilitate drying. Necessary dark-room accessories include a thermometer to check the temperature of the solutions and a good clock to insure accurate developing time.

The type of table will vary with individual needs. It should be of convenient height to work and high enough so that the tube can be placed beneath it for fluoroscope, but low enough that an adequate distance from the tube to the film can be obtained for radiography. It should

*Presented at the 64th annual meeting of the Indiana State Veterinary Medical Association, Indianapolis, January 15-17, 1948.

**Radiologist, University of Wisconsin.

be sturdy and, of course, the top should be of some material which x-rays will penetrate readily if it is to be used for fluoroscopy; plywood with a sheet of aluminum on top is excellent. If the table is metal it should be grounded. Various restraining devices may be added including the noose-type for the extremities and a wide band which fastens from side to side over the abdomen or thorax will be helpful.

Other necessary equipment includes film holders, both cassettes with intensifying screens and cardboard holders; at least one cone to cut down scattered irradiation; a stationary grid for heavy animals; lead rubber gloves; a lead rubber apron; sheets of lead or lead rubber of the size of the cassettes; and lead numbers or letters or other means of identification.

Cassettes are hinged metal frames with a bakelite or plastic front in which the film is placed during the x-ray exposure. They are lined by intensifying screens which fluoresce during the x-ray exposure and shorten the time necessary to blacken the film by adding the effect of fluorescent light to the x-ray effect upon the emulsion. Cassettes with fast intensifying screens are necessary for good films of any part thicker than an extremity. For extremities, cardboard holders may be used and excellent detail is obtained, but the time necessary for penetration of thick parts with cardboard holders limits their usefulness. The number and sizes and holders will depend again upon the type of work to be done. Cassettes are available in 5x7, 6x8, 10x12, and 14x17 inch sizes. For most small animals a 10x12 inch cassette would be large enough for the chest or abdomen and smaller ones for extremities. The larger cassettes may be used to take two or more views of an extremity by covering half of the cassette with lead rubber during the first exposure and then covering the exposed half of the film during the second exposure; this procedure not only saves film, but is convenient if x-rays of both extremities are desired for comparison or for two views of a fracture or bone lesion.

For heavy animals and for films of the abdomen and pelvis, a grid is helpful and will give much better detail, although the time of exposure is increased somewhat. Grids are of two types, the movable Potter-Bucky diaphragm which is for use with stationary equipment, and the Lysholm grid which is used with the portable or mobile units and in fluoroscopy. The Lysholm grid is constructed of thin strips of lead and wood parallel to the x-ray beam, thus eliminating the effect of scattered irradiation on the film which would cause a blurring of the image and loss of detail.

Finally, films must be identified if they are to be useful as records. Lead markers which are placed on the film holder at the time of exposure are the most satisfactory method. Films should also be marked with an "R" or and "L" to designate right or left sides of the body.

Radiographs are essentially shadow pictures of the part of the body exposed and are produced because the x-ray beam penetrates the tissues of the body according to the varied densities, thus in a chest film the lungs because of their air content permit passage of most of the beam blackening the film greatly, the heart and other soft tissues absorb more of the beam and are seen as grayish masses, while the bones because of their calcium content permit the least penetration and appear almost white on the film. Fat is quite radiolucent and aids in outlining soft tissue structures. Thus in the abdomen, although the contrast between organs is not as great as it is in the chest, by the mass of the various structures and the fat in the capsules, interpretation can be made. In addition, of course, various opaque contrast media may be used.

Since the x-ray is a "shadowgraph," the laws for shadow formation must be taken into consideration, and from them several basic rules for obtaining good films are derived:

1. The part to be x-rayed should be as close to the film as possible to prevent distortion. The farther away from the film the part is, the larger and less clearly defined it will be.

2. The tube film distance should be relatively great, at least 30 inches and preferably 36 inches. As has been mentioned previously, in choosing a table it should be of such a height that this distance can be obtained when the tube is moved upward on the tube-stand for radiography. When it is impossible to approximate the part to the film, at least partial compensation of the distortion may be obtained by increasing tube film distance.

3. As has also been mentioned previously, the size of the focal spot on the tube is important because x-rays are given off from all parts of the focal spot and the larger the area of the focal spot the more rays will strike each surface of the object x-rayed.

4. The x-ray beam should be perpendicular to the part to be x-rayed unless distortion is desired. For example, it may be desirable particularly in the skull to distort the normal antomy in order to separate bony structures which would otherwise be superimposed.

5. As a corollary, the part to be radiographed should be parallel to the plane of the film, or similar distortion will occur.

The four prime factors in radiography are milliamperage, distance, time, and kilovoltage.

Since the most practical machine for veterinary practice is the portable or mobile unit, variation in milliamperage is necessarily limited, and although tube output increases in direct proportion to increase in milliamperage, the tube ratings on these machines will probably not exceed 30 milliamperes. A standard milliamperage, therefore, of from 15 to 30 depending upon the tube should be adopted for radiography.

The intensity of irradiation is proportional to the square of the distance from the focal spot to the film. That is, if a given intensity is maintained at the focal spot, the amount of blackening of the film will depend upon the distance it is from the focal spot. Thus, per square inch of film, the amount of blackening 20 inches from the focal spot will be four times as great as the blackening on a film placed at 40 inches. In increasing focal-film distance, compensation in other factors must be made. The greater the distance, the less the distortion of the image, but increase in distance is limited by this intensity factor in the output of the machine.

Time and kilovoltage, therefore, offer the greatest possibility for variation. Time, of course, must be short enough that immobilization of the part to be radiographed can be maintained. The choice of film holder is helpful in reducing time, since with fast screens the time necessary to obtain adequate exposure is roughly one-fourth that for cardboard holders. Time, then, will vary from 1/20 or 1/10 of a second for chest radiography to 4 or 5 seconds for the lumbar spine and skull.

Kilovoltage determines the penetration of the part being radiographed, other factors being equal, and largely controls the contrast between various structures in the film. Thus high kilovoltage, although thick parts are penetrated, will produce a radiograph in which there is little differentiation in the various organ outlines, the entire film having a grayed flat appearance. Low kilovoltage on the other hand will give a great deal of contrast as far as the blacks and whites of film composition are concerned but because of lack of penetration there will be little fine detail. Thus kilovoltage selection must be made according to the thickness of the part to be examined to insure adequate penetration, and at the same time to preserve soft tissue outlines. Because there is individual variance in x-ray generators, the actual machine settings for kilovoltage are not indicators of the kilovoltage obtained, and therefore technic are not reproducible when only machine settings are given. However, by using standard technic charts furnished with the machine and varying the factors until good films of a given part are obtained, additional changes for differences in thickness are easily made. This or a similar procedure is always necessary when a new machine or a new generator is installed.

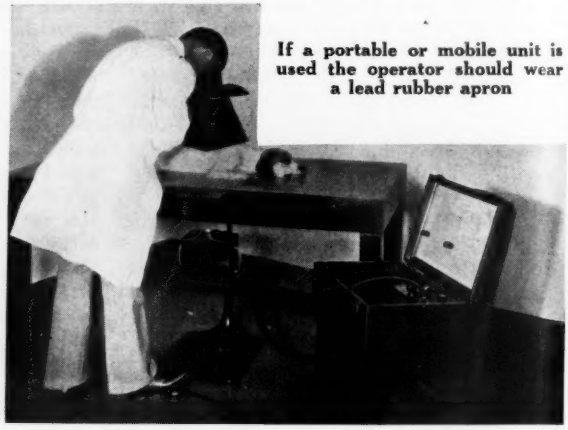
When the beam of x-rays passes through the body, part of the beam penetrates completely, part is absorbed by the tissues and part of the rays are scattered. Although the scattered irradiation aids in blackening the film, it causes blurring of outline and loss of detail and contrast. For example, radiography of the abdomen in large animals is not entirely satisfactory, not only because of the increased distance from the film but also because of the amount of scattered radiation produced in penetrating the thickness of the animal. Scattered irradiation is given off in all directions from the object struck; therefore a second source which also causes fogging of film is from the table top beneath the cassette, particularly if the table top is wood.

Several techniques may be employed to reduce the effect of scatter. The first is the use of lead under the cassette during radiography either by purchasing lead bracked cassettes or by using a sheet of lead or lead rubber on the table top. Cardboard film holders have lead foil in the back which absorbs scatter. The second method is the use of cylinders or cones attached to the tube housing. X-rays are given off in a coneshaped beam with the outermost rays at an angle, therefore by limiting this cone and using only the central ray, scatter is reduced. However, exposure time or kilovoltage must be increased slightly to compensate for that portion of the beam which is eliminated. A third method is the use of a grid. By construction, only that portion of the irradiation which is primary from the tube or parallel in direction can reach the film. The movable Potter-Bucky diaphragm is in motion during the exposure and the grid lines do not show. With a stationary Lysholm grid the grid lines are very fine and do not interfere with interpretation. Again either time or kilovoltage must be increased to compensate for the decrease in intensity.

To determine the factors for a given radiograph then, the animal should be placed on the table with the anatomical part desired placed close to the film, parallel to it and immobilized. A lead identification marker is placed on the film. The tube should be centered to the film and elevated the distance which has been predetermined. The machine is then set for the desired milliamperage. Time and kilovoltage are determined by the thickness of the part, the type of body tissue, the penetration desired, whether cardboard film holders or cassettes

with screens are used, and whether a cone or a grid is used. By considering these factors a chart can be made for any individual machine after a few trial exposures to standardize the technic for various anatomical structures.

For fluoroscopy, two types of fluorescent screens, which can be attached to the table, are available for use with portable or mobile units. They allow the hands to be free. In addition there is a small portable screen, in the end of a box-like apparatus into which the operator looks.) A foot switch for ease of operation is desirable. The tube is placed beneath the examining table with the beam perpendicular to the table top, and the animal placed on the table and centered over the tube. The discussion of shadow formation and of secondary irradiation apply to fluoroscopy as well as to radiography. Therefore, use of the small central beam of x-rays and close approximation of the fluoroscopic screen to the part will give the least distortion of the image. Fluoroscopic tables are equipped with shutters which narrow the aperture through which the beam passes and by eliminating scattered irradiation improve the image. With a mobile unit and examining table, a comparable effect may be obtained by using a cone on the tube and by placing a sheet of lead rubber with the center cut out on the table top. Not only is the image on the fluoroscopic screen improved by the use of a small aperture, but the examiner is protected also.



If a portable or mobile unit is used the operator should wear a lead rubber apron

For fluoroscopy, the machine is operated at three or four milliamperes and 65 to 80 kilovolts. Illumination is not great and the examiner must have his eyes well accommodated to darkness in order to see the image clearly. Special dark glasses may be worn to accommodate or the individual may sit in the darkened room for a minimum of 10 to 15 minutes.

The effect of x-ray irradiation on the body is cumulative; therefore, although the effect of any single exposure may be negligible, the amount over a long period can cause disastrous results. It is of particular importance to realize that x-ray gives rise to no sensation; it cannot be seen or felt and the effect upon the skin in any one large dose is not manifested until sometime later, a matter of hours or days depending upon the amount. The skin reaction is characterized first by an erythema, later by a dry superficial desquamation, and followed by vesiculation, which may lead to ulceration. These lesions heal slowly and the end result is an atrophic scar with superficial telangiectasia. Breakdown of the scar may occur after minor trauma years later and give rise to the painful indolent roentgen ulcer which in turn may undergo malignant degeneration to become the highly malignant so-called roentgen carcinoma. Small repeated suberythema doses will cause the same sequence of events.

Even more important than the effect on the skin is the effect upon the blood and particularly upon the white blood cells. It has been established that the incidence of leucemia among radiologists is more than 10 times as frequent as among physicians who are not radiologists. Although the mechanism is not entirely clear, apparently it is due to the repeated small insults to the white blood cell forming tissues. A much more common finding, and an early one, is a reduction in the number of white blood cells and particularly lymphocytes.

Observation then of proper precations is an absolute necessity, and is entirely within the realm of office procedure. In the first place, the tube should be shielded so that x-rays are given off only through the exit for the beam. Modern shock-proof equipment is constructed in this manner. Secondly, the operator should not hold animals to be radiographed. Immobilization should be accomplised by means of restraining devices and sedation. If a portable or mobile unit is used, the operator is necessarily relatively close to the x-ray beam and should therefore wear a lead upron while making exposures. It should be remembered that scattered irradiation is given off in all directions from the subject while the exposure is being made. Cones, of course, aid in shielding the operator from the primary beam.

During fluoroscopy, the operator should wear a lead rubber apron, and lead gloves. At no

time should he expose himself to the direct beam. Fluoroscopic screens are covered by lead glass to protect the face and the aperture for the primary beam should be small enough that it is entirely covered by the fluoroscopic screen with its protective lead glass at all times. By observation of these rules, the operator should be adequately protected and will not receive more than the calculated $1x10^{-5}$ roentgens per day which is thought to be the maximum safe exposure. To be certain that this amount is not exceeded, the operator may wear a dental film clipped to his shirt pocket for ten days to two weeks. If when the film is developed, the shadow of the paper clip can be seen, too much exposure has been received and additional precautions should be taken.

Overexposure of the animal may lead to epilation or to a skin reaction. It is always a temptation to use the fluoroscope for just one more minute particularly when setting a fracture or searching for a foreign body. There is a simple workable rule, which is taught to student x-ray technicians, based on the usual output of diagnostic equipment which is quite helpful. It is known that 300 roentgens from a tube operated at not more than 85kv with a filtration of one millimeter of aluminum is well within the limits of safety. Approximately this amount of irradiation is given off at 15 inches from the tube in 1200 milliampere seconds or milliamperes multiplied by time. Thus if the focal spot of the tube is 15 inches below the top of the table and the machine is set for 4 milliamperes at 85kv, with a filter of one millimeter of aluminum in place, fluoroscopy may be safely carried out in one skin area for five minutes. Using the same rule, safe exposures for radiography can also be calculated. Since the intensity varies inversely as the square of the distance, if the tube is 36 inches above the table and the thickness of the part is six inches, the skin area nearest the tube will be 30 inches and will receive one fourth the amount of irradiation it would receive for the fluoroscopic procedure. Safely then 4800 milliampere seconds could be used. Thus for example a heavy animal is to be raidographed and the factors are 85kv at 30 milliamperes for one-half second, the exposure requires 15 milliampere seconds and many such exposures could be made. There are tables available giving much more accurate calculations, but these rather arbitrary limits are helpful for ordinary usage.

Protection from electrical shock should be carried out as for any electrical ekuipment.

In summary, the most useful machine for ordinary office practice is the mobile unit; equipment need not be elaborate, but must in- and for the animal. There are a number of simple rules for good radiography and although there is a moderate amount of trial and error necessary to standardize technic, if the basic principles are observed, a workable system is not too difficult to accomplish.

Questions and Answers

Dr. Magrane: Will you please discuss calibration briefly, and also under exposure. What period is necessary for x-rays to eliminate themselves from the body, assuming one has reached a point where the dental plate showed the clip on exposure.

Reply: Calibration is done. usually, by a physicist. There are men in Chicago who calibrate most of the machines for radiologists in this part of the country. It is done with a small ionization chamber. The calibration is in roentgens, which is the unit of output in x-rays, and the machine is calibrated for output against time with various filters.

Your second question was what period is necessary for these x-rays to eliminate themselves from the body, assuming you have reached that point where the dental plate shows the clip on exposure. That is a very rough determination and only a qualitative one. No one is quite sure what the exact safe dose is. We say 10 —5r per second or less than 0.1r per day. We don't know that is absolutely safe. The number of roentgens by the other rule, which I gave you, should not be repeated in a shorter period than three weeks. If I found myself exposed to more x-ray, i. e., enough x-ray that the clip would show on the dental film, I would increase my precautions, but I think I would probably go ahead, being a radiologist and necessarily having to use x-rays. There are a number of other rules set up by the committee on protection, including limiting the number of hours in which one should work with x-rays and also including a month's vacation, preferably during the summer.

Dr. Miller: What period of exposure would you say is dangerous? I mean how many minutes or seconds? I am speaking of a machine, which handles a maximum exposure of eight seconds at a time. By the time it is wound ready for a new look probably eight or 10 seconds or maybe 20 seconds have elapsed between each of these eight-second exposures.

Reply: You can calculate that by this rule: if you are fluoroscoping at four milliamperes and the focal spot of the tube is 15 inches beneath the top of the table, and your kilovoltage is not greater than 85kv, it gives you five minutes of fluoroscopy.

Dr. Miller: Over five minutes are dangerous?

Reply: Over five minutes would exceed this 300r output. 300r is well within the safe limits to produce an erythema and for most diagnostic machines the quality of radiation given off is such that the output of 300r is considered safe. Five minutes when you are stepping on and off a foot switch is quite a long time.

Dr. Cain: Are some persons more tolerant to exposure to x-ray than others?

Reply: We find it so in x-ray therapy. A smaller amount of x-ray of a given quality will produce a skin reaction far more rapidly in certain individuals than others. For some reason the skin of a blond individual is much less sensitive than that of a brunette or redhead; however, that has no bearing upon the amount of x-ray the bloodstream or the white blood cell-forming tissues can tolerate. We don't know how little is safe.

Brucellosis in Public Health Work in Indiana*

By RAYMOND FAGAN, D.V.M.**
Indianapolis, Indiana

OUR brucellosis survey is a cooperative program by four agencies, Purdue University, the Indiana State Board of Health, the United States Bureau of Animal Industry, and the United States Public Health Service.

At the beginning of last year we were able to get some work done, but the foot-and-mouth disease outbreak in Mexico has interfered with this activity, as the B.A.I. representative assisting in the survey had to be withdrawn for duty in Mexico.

In our attempts to find means to isolate the Brucella organism from human blood we are cooperating with Purdue University. In this experiment the cultural work is done at the State Board of Health and Purdue University does the guinea pig inoculation. Together we have examined 840 samples; obtaining 51 isolations from 48 patients. By cultural technics 26 isolations were obtained and by guinea pig inoculation, 25 isolations. The culture and guinea pig technics agreed in isolations. This means that from the guinea pig alone we obtained 14 and from the culture alone got 16 isolations. These preliminary results indicate the need for the use of both methods.

In the southwest part of the state a survey was made of all the animals and all the human beings in two townships. That area was picked primarily to test our methods of approach. What we found in that area can not be used as representative of the situation in Indiana. It was thought we wouldn't find much brucellosis there, and therefore our problems wouldn't be too great.

We tested 1545 cattle, of which 27 reacted—1.75%. Of 746 swine, 36 reacted—approximately 5%. We tested 122 horses, of which only one reacted; and miscellaneous goats and sheep, getting no reactions. All together we included in the survey 272 of 273 farms in the area. The inhabitants were perfectly willing to cooperate in this plan. We divided the human population into two groups: (1) those who had contact with animals, and (2) those who had no contact with animals. All drank raw milk, so that is a constant factor. Of the 218 persons who had no history of contact with animals, none reacted. Of the 721 who had contact with animals, 11 reacted, or 1.5%.

The distribution of reactors is more interesting than the total number of reactors. Of 190 men, seven reacted—3.7%. Of 128 women, two reacted—1.6%. Of 114 male students, two reacted—1.8%; and of 73 girl students none reacted. We point out the indication that contact with animals is the main source of brucellosis infection in humans in the area surveyed.

We have tested some groups of persons intensely exposed to animal contact. Of 320 veterinarians tested at the national meeting in Cincinnati and at the meeting of this association a year ago, 96 (30%) reacted. Of 142 workers in rendering plants, 39 (37.4%) reacted; of 394 slaughterhouse workers 51 (12.9%) reacted.

As a control group, we picked inmates of state institutions. They draw their population from all over the state, from all sorts of homes, at all economic levels, and from all types of culture. With one exception the institutions had brucellosis free herds. We tested all persons in these institutions who came in contact with animals. Of 326 tested, four reacted.

The types of Brucella organisms that we have found in human blood is not without interest. There were 31 *B. abortus*, 67.4%; 10 *B. suis*, 21.7%, and five *B. melitensis*, 10.9%. This disagrees with what was discovered in a brucellosis survey in Iowa, but it is in agreement with the situation in Minnesota. A recent communication from the research workers in Iowa states that within the last two years the number of *B. abortus* isolations have risen rapidly; so it may be, when the total scores are drawn up, the abortus type will be found to be the main source of human infection. Comparing the degree of brucellosis infections of Indiana veterinarians with out-of-state veterinarians, we find: of 93 samples of blood from Indiana veterinarians, 36 or 39% reacted. Of 215 out-of-state veterinarians, at the Cincinnati meeting, 38 or 18% were reactors. We would like very much through our cooperative survey to make this same test at every meeting of the A.V.M.A. As it holds conventions in different parts of the country we feel this will be a better indication of what the situation is among all veterinarians.

In the A.V.M.A. study, we found the highest percentage reactors among the young men, men who had just gone into practice. We had among our samples as many from older men as from younger men, so, if this is a representative sample, it seems, the young men pick up a titer early in their practice. In many cases it apparently disappears later in life. However, all the studies so far are preliminary and do not justify drawing definite conclusions.

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**Veterinary Epidemiologist, Indiana State Board of Health.

Correlation of Research With Brucellosis Control*

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Washington, D. C.

FROM a practical viewpoint, I think we, as veterinarians, would be among the first to take exception to the old adage that there is nothing new under the sun. Nevertheless, when it comes to breaking down some of the antiquated concepts of disease control practices, there is reason to suspect that the axiom has a surprisingly large following.

A case in point is the dogmatic manner in which many of our livestock sanitarians have refused to keep pace with the advancements of science. No one denies the fact that the fundamental basis of all programs designed for the control of infectious and contagious livestock diseases, stems from the contributions provided by original research. Yet, there is often a peculiar hesitancy to accept and utilize the improvements and principles that inevitably follow basic studies.

Brucellosis control is no exception in this regard and demonstrates clearly the confusion that can result when the best interests of the program as a whole are subordinated to personal opinions. Unfortunately, many times these personal views are in direct contradiction to practical experience and the evidence supplied by competent research. With the public health aspects entering the picture more and more, it becomes essential for the veterinary profession, the livestock industry, and the livestock sanitarians to reconcile their differences, regarding methods for combating brucellosis, as quickly as possible. Even though our immediate consideration, as veterinarians, is primarily one of protecting the livestock industry against the ravages of this disease, we cannot afford to ignore its relationship to human health. Unless we are able to cope with the situation ourselves, it is quite likely that we shall be faced eventually with restrictive regulations governing the sale and distribution of meat and dairy products, that will make any of our present control procedures seem mild by comparison.

Having been actively engaged in brucellosis research until recently, I believe that research and field control activities have much to gain by a closer working arrangement than has existed in the past. The problems that develop in the field are frequently unobserved under strictly experimental conditions, and unless they are brought to the attention of the research workers promptly, will go unsolved longer than would otherwise be necessary. On the other hand, it is equally important that properly verified results of controlled investigations be made available, quickly, to the field control agencies, in order that the incorporation of all worthwhile improvements in existing procedures, be not delayed. One of the most obvious conclusions, in regard to brucellosis control, is that we must either go forward or lose ground. The only static point that can ever be reached, so far as this or any other contagious disease control program is concerned, will be when complete eradication has been accomplished. Until this occurs, the only way to insure our forward progress is by maintaining an intimate relationship between research and field activities. There is no place or reason for jealousy to interfere in a disease control program, that is as vitally important to the welfare of our country as brucellosis eradication.

Estimated Cost to the Nation of Bovine Brucellosis

From an economic standpoint alone, there is probably no single disease of cattle in the United States that is more important than brucellosis. It is very difficult, of course, to arrive at a definite figure for the dollar losses it incurs, because of the wide range of intangible factors involved. Before systematic eradication of bovine brucellosis began in 1934, losses from this disease were estimated at 50 million dollars annually. Since that time the incidence of infection has been gradually reduced and livestock values have soared to much higher levels. Consequently, in view of these changes it was considered advisable to bring these estimates up-to-date. With this in mind, I would like to give you a summarization of my own figures on the subject, which I have compiled recently. Aside from their financial aspects, I think they will help to refresh some

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of your memories on certain phases of bovine brucellosis that are often forgotten.

With regard to dairy cows, the extent of milk losses occasioned by *Brucella abortus* infection is not fully realized, either by the industry itself or by the general public. At the present time, the number of milk cows in the United States is around 26 million. On the basis of current Federal-State cooperative test results, showing an over-all infection rate for the country of approximately 5%, we have, at least one-and-one-third million infected dairy cattle two years of age or older. From national averages, these one-and-one-third million dairy cows should produce about 6,358,000,000 pounds of milk each year, if not infected. The estimated 20% loss in milk production by Brucella-infected cows reduces this figure by 1,271,600,000 pounds, which at the current price of about $4 per hundred pounds means an annual loss of something over $50,000,000.

In addition to losses in milk, the reduction in calf crops must be considered. For dairy cattle alone, the 15% estimated annual rate of abortion or sterility resulting from brucellosis would account for a loss of 195,750 calves each year. At current veal prices ($21.30 per cwt.) this would mean an approximate loss of five million dollars. Moreover, about one-quarter of the total dairy calf crop is saved for replacement purposes each year, and the above figure does not include the additional value that rightfully should be placed on the 49,000 lost calves in this category.

Carrying these estimations for dairy cattle a step further, we must recognize the need for replacing cows affected with brucellosis. A reasonable estimate for the number of cows that must be replaced in dairy herds each year, as a result of Brucella infection (exclusive of brucellosis testing) is 2%. On this basis, a total of 522,000 dairy cows must be replaced annually. And calculated on an average per head value of $145, these replacements would cost the dairy industry $75,690,000. Average salvage received for cattle condemned during the fiscal year 1947 in connection with cooperative Federal-State brucellosis field work was $82.93 per head. This would reduce the over-all loss by $43,289,460, leaving a net loss of $32,400,540 resulting from the purchase of animals needed to replace those that are removed from herds for economic reasons directly or indirectly related to bovine brucellosis.

From the standpoint of replacements and milk and calf losses alone, we have, therefore, accounted for a total annual loss to the dairy industry of about $88,500,000, resulting from brucellosis, and nothing has been said, as yet, about the beef cattle.

Since there does not appear to be a great deal of differences in the degree of infection present in dairy and beef animals, the same basis for calculations can be reasonably used for each group. Obviously the losses estimated for strictly beef animals cannot include the same milk losses as for dairy cattle, and are, therefore, omitted entirely from this computation. The identical 15% calf loss figure upon which estimates of abortion and sterility losses were made for dairy cattle are used in figuring the same losses for beef cattle. On this basis and the 1947 estimate of 16,360,000 for the number of strictly beef cows over two years of age in the United States, brucellosis in beef cattle accounts for a probable annual loss of 122,700 calves. At current veal prices of around $21.30 per hundred pounds live weight, these calves had a potential value of $3,250,000.

Because of the wide variety of practices followed in different sections of the country, no attempt has been made to determine the extra value these same calves might have had under general beef-feeding and breeding operations. Another deliberate omission in the calculations for both dairy and beef cattle is the losses in normal calfhood gains that necessarily accompany the losses in milk resulting from bovine brucellosis. While such losses are not inconsiderable, the basis upon which they can be evaluated is far too vague for my interpretation.

As pointed out at the beginning, any figure arrived at for the yearly economic losses caused by brucellosis in cattle, must be a broad estimation and should be accepted as such. The bases upon which calculations of this nature can be made are, for the most part, only approximations themselves. Thus, in arriving at the total estimate of almost 92 million dollars for the yearly monetary losses suffered by the cattle industry because of brucellosis, every effort has been made to lean heavily toward the conservative side. In support of the belief that this has been done in assembling these data, your attention is called to the fact that a number of elements have not been considered at all, due to a lack of acceptable information upon which to base even tentative estimations.

Even though the incidence of bovine brucellosis has been reduced by about one-half since 1934, when losses from the disease were estimated at 50 million dollars, we are still faced with a probable loss from the same cause of about double what it was when the original estimates were made. This is due largely to differences in current values of meat and dairy products, as compared with those prevailing 13 years ago.

Factors That Have Delayed Final Eradication of Bovine Brucellosis

Personnel Problem.—Until the past few years, very creditable progress has resulted from our efforts to control brucellosis in cattle. Some of the reasons for the more recent slowup are readily apparent, while others are more obscure. One of the primary factors was the disturbed economic situation that began to confront us during the late pre-war period when prices started to take an abrupt upward turn. The contributing heavy demands for meat and dairy products were, in turn, responsible for an unprecedented need for veterinary service by the livestock industry. As a consequence, general practice has attracted a greater percentage of the new graduates than ever before. Needless to say, regulatory activities which are staffed largely by veterinarians suffered accordingly. From this position, we moved directly into active participation in the war with its associated unbalances. The wartime reduction in qualified state and Bureau regulatory personnel was not unexpected, and the most that was hoped for was to hold the line on our livestock diseases until the emergency was over. Unfortunately for disease control activities, this so-called emergency failed to end with the war, and post-war years have not seen the expected relief of the veterinary personnel situation. At the present time, the Bureau of Animal Industry has about 150 vacancies in tuberculosis and brucellosis eradication field work, and the prospects of filling any significant number of them within the immediate future are extremely dim.

Further complications resulted from the foot-and-mouth disease outbreak in Mexico. In order to meet the demands from this direction, it has been necessary to detail for an indefinite period a number of key men from the already badly depleted tuberculosis and brucellosis control force to Mexico. The same relative personnel shortages have been reflected also in the various state livestock sanitary forces, with the result that ground has been lost in our brucellosis fight. Right here I would like to underline a fact that should not be overlooked by any of us in the veterinary profession. This concerns our responsibility for meeting the personnel requirements of vital disease control activities such as brucellosis eradication. You, as practicing veterinarians, must play an increasingly prominent role in this campaign if it is to succeed.

The same economic disturbances that have accounted for the acute shortage of veterinarians, have interfered also with other phases of the program. Normally, the movement of livestock is difficult to regulate from a disease control standpoint. With present inflated demands on the industry, these difficulties have multiplied to the point where available personnel and existing regulations are unable to cope with the situation adequately. Such being the case, increased dissemination of all livestock diseases has taken place and is the cause of many new sites of Brucella infection being identified in previously clean areas. Prevailing high prices being paid for dairy and meat products have also resulted in a general reluctance on the part of owners to carry on any disease control plan that is restrictive in character. This will probably remain unchanged until values have reached a more permanent level.

Disregard of Proved Facts.—Although the influence of national economy on the delayed progress of brucellosis control is signally important, considerable responsibility rightly should be placed directly in our own laps. The indecisions and lack of agreement within the veterinary profession itself are certainly contributing factors which have made us the object of severe criticism from lay sources.

The underlying cause for much of the confused thinking within all interested groups, including the veterinary profession, has been the mistaken belief that bovine brucellosis eradication could be handled in exactly the same manner as tuberculosis eradication. The fallacy of this view has been clearly demonstrated by the frequent failures associated with any single method of control that is applied to all types of herds regardless of existing conditions. The complex nature of bovine brucellosis is undeniable and cannot be overlooked if maximum results from any control plan are to be realized. Variations in the types of herds affected, differences in the character of the disease as it affects various herds, and the length of time infection has been present, are all elements that must be considered in the selection and application of control measures. The last-mentioned point, namely, the length of time infection has been present in the herd, is a very important factor from the standpoint of results that may be anticipated from control efforts. In herds in which the disease has been introduced recently and is accompanied by frequent abortions, there is far less chance of prompt success with any procedure than in herds that have passed through the violent, early stages of infection and abortions have become infrequent. The most favorable time to commence eradication in a given infected herd would be after clinical manifestations have subsided. This, of course, is rarely possible, and adds to the problems encountered in routine control practices.

The research that has been accomplished on bovine brucellosis is voluminous, and I have no intention of discussing more than a small fraction of it at this time. However, in order to correct the erroneous impression left by certain unqualified writers of popular articles that little, if anything, is known about this disease, I would like to restate, briefly, some fundamental facts about bovine brucellosis that are basic to our understanding of the disease and essential to the formulation and application of an effective control program.

1. The infected uterus at the time of abortion or at an apparently normal calving is the most important source for the spread of infection, even though the uterus tends to free itself of *Brucella abortus* within a short period after parturition.

2. Young calves are resistant to the disease and rarely, if ever, become permanently infected. The disease primarily affects sexually mature animals, especially females during pregnancy.

3. Active Brucella infection in cows is usually accompanied by localization of the organism in the udder where it is readily disseminated through the milk.

4. In addition to the characteristic symptom of abortion, other commonly observed sequelae are diminished milk supply, through either (a) a lessened flow due to the diseased condition of the udder, or (b) being dry for excessive periods; loss of calves; retention of afterbirth; and sterility of either a temporary or permanent nature.

5. Of the cows which abort once as a result of Brucella abortus infection, only about 10% will abort a second time, even though they may remain infected and represent a hazard as spreaders.

As you probably know, it is this characteristic of bovine brucellosis that has been the main support of alleged cures for the disease.

6. To-date, no specific cure for brucellosis in either man or animals has been discovered. Extensive investigations of such new agents as the sulfonamides. penicillin, and streptomycin have shown these products to be even less effective in animals than in man, where their usefulness is admitedly limited.

7. About 10 to 12% of Brucella-infected cattle will spontaneously recover from the disease. This is an over-all figure which cannot be predicted for the variety of conditions found in the field and has to be ignored from a control point of view. Generally speaking, the infection becomes permanently established.

8. Bulls only rarely become actively infected even under conditions where heavy exposure prevails. Such being the case, they are only infrequently responsible for transmission of the disease.

9. Although young calves are resistant to brucellosis, those nursing or recently weaned from infected dams are a potential source of exposure for susceptible animals, owing to the probable presence of infecting organisms in the milk they have been consuming.

10. The blood agglutination test, when properly performed, is a reliable means for diagnosing brucellosis in cattle. Its accuracy is considered equal to or higher than that of most other biological tests, including the tuberculin test that was so effectively used in the tuberculosis eradication program. There are, of course, limitations to the blood test, but with the present standardization of procedures and materials, these have been reduced to a minimum.*

11. In spite of some rather emphatic opinions to the contrary, there is no experimental evidence that the act of parturition interferes one way or the other with the accuracy of the blood agglutination test in detecting Brucella infections in cattle.

12. Although Strain 19 vaccine possesses valuable prophylactic qualities, it has absolutely no curative properties, and its use in infected animals can only lead to disappointing results.

13. There is no evidence that vaccination with Strain 19 will ever establish the disease in vaccinated animals, nor that such individuals are capable of transmitting the vaccinal organism to susceptible contact animals. On the contrary, deliberate attempts to increase the virulence of the vaccine culture to the point that it would become pathogenic for cattle have consistently failed.

14. The effectiveness of Strain 19 vaccination increases with the age of the animal at the time of administration during the first year of life. Vaccinal blood agglutination reactions are likewise increasingly persistent in relation to the age before maturity that vaccination is practiced.

15. Although the resistance induced in healthy adult cattle by vaccination is at least as great as that provided in calves, the resulting blood titers tend to persist for indefinite periods. Because these reactions cannot be differentiated from those associated with virulent infection, the vaccination of mature animals automatically places them in the class of potentially infected individuals.

16. Even though valuable protection is afforded by Strain 19 vaccination, it is relative and not absolute. There is considerable evidence that several factors may modify the duration and serviceability of vaccinal resistance. Among these are: (a) virulence of exposure, (b) degree of exposure, and (c) the response of the individual animal to the original vaccinal stimulation. In all probability, any of these will appreciably alter the final protective values exhibited by vaccinated animals.

17. Strain 19 vaccine is a fragile product which quickly loses its potency when improperly handled.

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*A word or two about what has been accomplished by the standardization of antigens and procedure may be of interest at this point. During the past few years, the Bureau has carried out a series of check tests to determine the accuracy and uniformity of results obtained in the field. The most recent of these was completed in February 1947. It was set up in such a manner as to give a maximum number of interpretations on a limited group of samples. In order to accomplish this, the same set of seven selected serums was submitted three times to all cooperating laboratories at monthly intervals. The titers represented by these samples were within the critical diagnostic range where slight variations in test results are important from the standpoint of final disposition. The evaluations provided by this study were gratifying. Of 1,610 interpretations made by the tube test, 1,540, or 95.84 percent, were wthin the same acceptable range that was recorded for 1,881, or 93.3 percent, of the 2,016 interpretations made by the plate test. These results are especially significant when compared with the 87 percent agreement found in the same group of laboratories in 1938. As a follow-up on these tests, each laboratory that was found to be consistently out of line was later visited by a Bureau representative who endeavored through personal contacts to discover the reason for the errors. In most instances, certain mistakes in procedure were revealed that explained the poor performance.

An additional aid to the maintenance of standard quality in all Brucella antigens was instituted on January 1, 1946, through Bureau control of commercial production. All commercial antigens are now subjected to the same tests as those applied to the Bureau product before sale is permitted. What this all adds up to is that every precaution possible is being taken to insure maximum accuracy and uniformity of results for all blood agglutination tests performed under the official Federal-State cooperative brucellosis control program.

The resistance-inducing property of the vaccine is intimately related to the living quality of the constituent bacterial cells, and so long as the product is kept under suitable refrigeration, its viability and potency can be maintained over the permitted expiration time. However, freezing or temperatures above normal refrigeration ranges cause a rapid decrease in the number of living cells, and a corresponding reduction in potency. It is probable that a high percentage of reported vaccine failures are due to improper handling of the vaccine prior to its use.

18. A small percentage (1% or less) of cows negative to the agglutination test that are vaccinated during pregnancy will abort as a direct result of vaccination. The middle third of gestation appears to be the most dangerous period in this regard.

19. Vaccination of adult cattle is usually followed by a more or less severe systematic disturbance which, in lactating cows, causes a temporary decrease in milk flow. These general reactions can be minimized by holding all animals, including calves, indoors for 24 hours following vaccinations, during cold or inclement weather.

20. The development of unsightly lumps at the cites of inoculation can be largely overcome if the injected areas are well massaged.

21. Although the intradermic administration of Strain 19 vaccine may eventually prove to be equal or superior to the standard subcutaneous method, such information is not yet available. Therefore, the unreserved adoption of this procedure is not justified at present.

22. So-called "lyophilized" or desiccated Strain 19 vaccine, when properly prepared, will withstand temperature ranges that quickly destroy the viability of liquid suspensions. Such a product is now being marketed commercially in limited amounts, and when production problems are overcome, there is reason to believe that it may be the eventual solution to the handling of many fragile biologics, including *Brucella abortus* vaccine.

23. Studies concerning revaccination with Strain 19 are in progress at different research centers, but to-date, no conclusions have been reached as to the practicability of this procedure. Preliminary results indicate, however, that the persistent vaccinal reactions associated with a single vaccination of mature cattle may not be so pronounced in the case of multiple injections.

Except where indicated, all the fundamental facts I have presented in the foregoing are fully supported by research findings. However, a surprising amount of confusion still exists on some of these points. As a matter of fact, I deliberately included in this list a number of points that are really undebatable, but which are frequently discussed as if they were controversial subjects.

Need for Uniform Control Procedures

Another factor that has handicapped our progress in brucellosis control has been the lack of uniform regulations and recommendations governing the project. Instead of a unified, nation-wide program, each state has gone about the matter in its own way, with little regard for other state policies. It has long been evident that such division of effort is not accomplishing the desired results. There is little hope of eradicating bovine brucellosis or any other similar disease unless a cooperative move toward the best interests of the entire country is undertaken.

With this in mind, Doctor Simms called a conference in Washington, September 23 and 24, 1947, for the purpose of discussing the brucellosis situation. At the conclusion of this meeting, which was attended by representatives from a wide range of related fields, a committee report was adopted, recommending that existing plans be reviewed by appropriate committees representing the United States Livestock Sanitary Association and the Bureau of Animal Industry, looking toward the early unification of bovine brucellosis eradication procedures. This was done at the December 1947 meeting in Chicago, and from these discussions there has been submitted an outline of recommendations for uniform regulations that has the approval of both the United States Livestock Sanitary Association and the Bureau of Animal Industry. It is our sincere hope that these recommendations will be accepted by all the states in due time.

Insofar as established brucellosis control plans are concerned, there are only two basic procedures that can be considered. One is founded on the principle of identifying and removing infected animals from the herd as q u i c k l y as possible—the test-and-slaughter plan. The other depends upon the artificial production of resistance to the disease in otherwise susceptible cattle by vaccination. Both of these procedures have been sufficiently studied either alone or in combination to provide a clear picture of their advantages and disadvantages. I would like to discuss these principles with you briefly in connection with the recent recommendations of the United States Livestock Sanitary Association. With your permission, therefore, I will refer directly to that report, which all present have no doubt read.

Although these recommendations are by no means perfect, they provide a foundation upon which we can build toward the goal of eventual brucellosis eradication. Heretofore, our efforts have been spread over such a wide range that they were dissipated before much was accomplished.

There will be, no doubt, a great deal of discussion and controversy over some of the provisions of these recommendations before they are accepted as minimum requirements for brucellosis eradication by all the states. However, I am sure that every state will endeavor to fall in line as soon as any conflicts in existing regulations can be removed.

The theme of these recommendations emphasizes the point that no single procedure is equally suitable for controlling brucellosis in all herds. The fact that best results from either test-and-slaughter or vaccination are obtained under conditions that are quite unlike, offers proof that the tools for a program flexible enough to meet the requirements of any herd are available. All that remains for the successful application of these measures is the acceptance of a unified program such as we now have before us.

The rapidity with which any livestock disease can be eradicated is closely related, also, to the intensity and scope of the control practices employed. Therefore, even though the present shortage of veterinary personnel available for control service will limit the amount of work that can be undertaken for the time being, the importance of expanding the program on an area-wide basis as soon as possible should not be overlooked.

The fact that cattle are not the only livestock species affected with brucellosis extends the problem of control to all susceptible groups. Until quite recently, it was believed that little cross-infection ever occurred, even though the three recognized Brucella types were known to be very closely related. We now know that cross-infection occurs much more frequently than was ever believed possible. *Brucella suis,* for example, the organism responsible for swine brucellosis, is being increasingly identified as an udder infection in cattle. In like manner, *Brucella melitensis,* the organism usually restricted to goats and sheep, has been found in swine and cattle. The knowledge that such inter-species transmission can occur, stresses the importance of maintaining effective segregation. It also suggests the need for considering other livestock species as possible sources of infection in cattle.

Conclusions

In conclusion, the following points in connection with the control and eradication of bovine brucellosis are so highly important that they cannot be repeated too often:

1. Eventual eradication of this disease is a tremendous and costly project that will require the wholehearted support of the livestock industry, the veterinary profession, and the general public. This does not mean that it is an impossible task, but rather, one that will require straight thinking and unified effort.

2. Only with a clear understanding of facts by all parties concerned can an intelligent and effective approach to the control problem be made. In this connection, it is especially important that all properly verified information be provided to the livestock people themselves, in order to counteract the unsound publicity that is being circulated by some of the lay press. Without the cooperation of the cattle owners, we cannot hope to accomplish our goal.

3. Vaccination alone is no more the entire solution to the brucellosis control problem than is test-and-slaughter. Each has certain advantages, as well as faults, that must be considered in the light of existing conditions, so that full use can be made of the better qualities of each. By complementing one with the other, along appropriate lines, much help can be provided for the program as a whole, without jeopardizing the progress already made.

4. Sanitation and good herd management must be an integral part of any plan if maximum benefits are to be obtained.

5. The final goal of all procedures should be the eradication of brucellosis and not its toleration. In many instances vaccination has been utilized only as a means whereby the disease could be lived with indefinitely.

6. Adult vaccination should be considered as a last resort, to be employed only in selected cases where the violent nature of the disease precludes the possibility of its control by other means.

7. Permanent recorded identification of all Strain 19 vaccinates is essential for the orderly promotion of brucellosis control.

8. Calf vaccination can be used safely in herds that are negative to the agglutination test, and for areas of heavy infection, it provides valuable insurance against introduced infection.

9. Indiscriminate vaccination with Strain 19 outside of the official program has only limited value from a long-range disease control standpoint. The confusion caused by unidentified vaccinates more than offsets any possible advantage this practice affords.

10. The effectiveness of Strain 19 vaccination depends entirely upon the viability of the vaccine. Therefore, in view of its unstable character, the product must be suitably handled if its potency is to be preserved.

11. Finally, even though brucellosis eradication is admittedly a formidable undertaking, it can be accomplished if a cooperative, well-directed effort is made. We may be sure that the benefits such an achievement will provide for the country at large, will more than repay us in satisfaction for a job well done.

Business Management in a General Practice*

By W. M. COFFEE, D.V.M.
La Center, Kentucky

I SHALL not attempt to tell you how to run your business. I am merely going to tell how my two associates and I operate our business in a rural mixed practice.

A first essential in any business is some type of record. We have worked out a form, that, in our practice, is very satisfactory. We make a record of every animal that comes in for treatment on a *hospital record card.* It contains the date, the name of the owner of the animal, his address, the species, sex, breed, and other pertinent data of the animal, and laboratory findings, if it happens to be an appropriate case for laboratory examination, such as urine analysis, fecal test, blood test, skin scrapings etc.; diagnosis, remarks, and treatment. If it should be an office call it is marked, office treatment. We then have the record available so that the next day or week, if the anmial returns we know exactly what was done on the previous call. When the case is dismissed the hospital record card is filed. In the event we are called upon we are able to produce the hospital record of any animal treated at any time.

Our *daily record* consists of an ordinary small book about 6x10 inches size and containing approximately 125 pages. We purchase these books by the dozen. In the daily record we list our calls as they are received, by telephone or otherwise; dating each day separately. The date is sometimes very important when we want to refer to a certain call. We prefer a book of this type to the loose leaf book or calendar pad where the leaves are torn off. Each veterinarian places his initial opposite the call when he takes it. This prevents others from doubling on it. When a book is filled, it is filed for reference.

The daily record contains the cash and charge calls together with the amount received on account, identified by the initial of the veterinarian at the close of each day's business. The daily operation of each veterinarian is recorded on the analysis sheet, showing his total cash, charge and collection for that day. When more than one is engaged in a practice a record of this type is essential to avoid confusion and to identify who rendered the services and made the collections, since we all sometimes forget to credit accounts.

At the end of the month the bookkeeper makes up a monthly analysis sheet. This sheet has on the expense side 10 columns which are headed: (1) invoice and check number, (2) drugs, (3) car expense, (4) car depreciation, (5) labor, (6) social security, (7) feed, (8) office expense, (9) fixed expense, and (10) total expense. On the reverse side there are seven columns headed: (1) cash business, (2) charge business, (3) total business, (4) total expense, (5) net profit, (6) received on account, and (7) receivables. When this sheet is properly posted we have a complete analysis of our business by departments. Adding the charge business for the month to last month's receivables and deducting our collections on accounts gives a picture of the amount of receivables at the end of each month. Often we know that our receivables or expenses are too high, but don't know just where to start adjusting it. By having the monthly analysis sheet showing the different departments we get a clearer picture of our operation and can see where adjustments are necessary.

Another good piece of business management for a practitioner, who carries large inventories of drugs and supplies is to take advantage of the fast moving items. Where we know about what amount we are going to use over a period of three or four months, we buy the whole quantity. Our favorite supply houses always welcome these large orders and give quantity discount prices. Above all things, we take advantage of cash discounts. Many big businesses pay dividends on 2% cash discounts.

A practitioner should take advantage also of his ability to compound a lot of preparations himself, and effect considerable savings in that way. Of course he should not neglect practice or professional reading to do this, but there are few of us that do not have idle time.

However, the business side of practice includes more than bookkeeping. We should refrain from criticizing a client for neglecting his animals or any treatment that he might have administered. Our clients are like ourselves. We don't like to be criticized. If we criticize a client for relying on some outmoded superstition in treating his cow, he may tell us that both the cow and the treatment were his and he would do as he pleased. This doesn't make for friends and good will. In cases of doubtful prognosis, emphasize that you can't give him much encouragement, but will do your best.

I firmly believe that we should always talk to our clients in terms that they can understand. It is good business practice. We should remember that after all we are selling them

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services, medicines, or good will. Talk to them about the things they are interested in.

Another thing, we should prepare now, for the future. Every business of any size had a postwar program. They planned what they would do to build business after the war. We veterinarians have an opportunity at present with the high price of livestock and the willingness of the livestock breeder to spend money on his animals, to build practice for the future. I know there are times when we get a call that we wish hadn't come, but there may be a day not too long off, when some of us may wish we could get a call—any call. I know all of us have said, "I will be glad when I can walk into a store and buy what I want. Where the salespersons will be courteous and interested in our needs." That same thing could be said, by the livestock owners, about veterinary service.

I have attended practically every veterinary association in the Southeast, and this is the first I have attended that has an active public relations department. I think it is a fine thing. We should take advantage of the A.V.M.A. radio program. It may be inconvenient to go to the station some mornings to give these talks, but it is seed properly sown for a rich harvest. There are some of our commercial houses also that deserve recognition for what they are doing to increase the value of veterinary service in the estimation of the public.

In addition to public relations programs, there are a number of things that we can do individually to sell veterinary service to our community. Each community has some medium of contact, either through public health, farm bureau extension work, or purebred breeder associations. When we cooperate with these organizations and talk to them about the things they are interested in, it is very easy to build good will for our profession among them.

Regardless of our present volume of business we owe to our clients prompt, courteous, honest, efficient veterinary service.

It is good business management to equip ourselves with sufficient laboratory facilities to make parasite checks for clients, county agents or any who want them. We render this service free , and once our clients are educated to the fact that there is more than one type of parasite, and different parasites require different treatment, they no longer patronize the patent medicine man or drug store when they want vermifuges. A great many will even employ the veterinarian for the anthelmintic treatment.

At the beginning of the war, in 1942,* we took advantage of the opportunity to cooperate with our county agents in an educational program on parasite control to conserve food, and produce more beef and pork. This program resulted in numerous contacts which materially increased our volume both of veterinary service and the sale of vermifuges.

It is also good business to establish a uniform fee for veterinary services that our clients can afford to pay and for which we can afford to work. If the fees are too high, many minor cases, especially surgery in swine, are attempted by the owner. In the event such attempts are successful we have made a competitor instead of a client.

Another feature in building practice and handling clients is in the proper restraint when handling an animal and anesthetics when indicated. It is worth while to take a minute or two and do a job right. Maybe it is only an extra rope needed for proper restraint. If it is a case that should be anestetized, farmers like it. In addition one can do a better job easier and also get a couple of extra dollars.

We have a set fee of five dollars for castration and we tell the client if he wants us to use an anesthesia and avoid the danger incident to casting the animal it will be two dollars extra. I never have an owner of an adult animal who doesn't want it anesthetized. At the same time it makes it much easier for me.

Another thing that builds veterinary practice is the manner in which we carry our biological products. When we go to do a job of vaccination, the client often reads the labels, and he sees that the product should be kept at a temperature of 45°F. If we should go out on a hot day with these biologics in a shipping carton, he wouldn't feel that we are handling them any different from the way he used to do when he went to the drug store and bought them or had them shipped by express and they lay in the express office over night. If these products are carried in a portable refrigerator, which is just as easy to carry as a box, and easier because it has a handle, when we open up a cool refrigerator and use the products from it, he feels that we have rendered him a service that he couldn't have obtained except through a veterinarian. (Water frozen in cans makes refrigeration easy.)

Intravenous and stomach tube medication build veterinary practice. Don't pass up an opportunity to build swine practice by neglecting to do, under general anesthesia, such swine surgery as intestinal anastamosis, cesarean section, adult boar castration, etc. These cases can be brought to your hospital with little effort on the part of the owner. A few cubic centimeters of nembutal in an ear vein and one can do a clean operation in a few minutes.

A client appreciates this service and at the same time realizes that he, himself, cannot do it that way.

THE MASTITIS PROBLEM*

By F. H: FOX, D.V.M.**
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THE mastitis problem is one I could not cover fully if I talked for 24 hours. In the short time allotted for this subject a hurried attempt will be made to synchronize our thoughts as to the cause, methods of diagnosis, and the treatment, both of the herd and of the individual animal.

First, let us define mastitis as an inflammation of the mammary gland. If "inflammation" be looked up in the dictionary it will be seen it can be due to infection. That point is stressed in the beginning so we may think alike all the way.

Mastitis is a disease that may be compared, for the purpose of explanation, with a cold in the human being. We all know that pathogenic organisms are present in the nasal chambers of practically every living person, but predisposing factors, such as exposure, sickness, or any "rundown" condition, will precipitate the symptoms of the "common cold." Such is the case in mastitis. Mastitis producing organisms are present in approximately 33% of the udders of cows in New York State. In a state-wide survey during the past two years, we have found there is approximately 10 to 12% of the cattle in the state producing clinically abnormal milk! This represents an estimated loss of 15 million dollars annually on milk production alone. That doesn't take into account the cattle that die of the disease or are sold for slaughter. Nor does it include the replacement for animals disposed of because of mastitis infection. I don't know the figures for the cost of mastitis in Indiana, but surmise they would not be so high because this is a state that has more swine raising and less dairying than New York.

No small part of the prevention of mastitis is the responsibility of the dairyman. I refer to such matters as proper barn construction and adequate bedding, keeping cows out of swamps and mudholes, proper adjustment of the milking machine and proper methods of milking etc.

The most satisfactory method of handling mastitis, both to the owner of the herd and to the veterinarian, is to treat an outbreak as a herd disease and take over the whole herd on a mastitis control program. The primary obstacle to this is the cost. Many farmers will not submit to a complete test of the herd until they absolutely are forced to do so. Then they say, "Doc, I have had my milk sent back from the New York milk shed twice now, and they won't let me send in any more milk until I do something about it." Then is when we can step in and really do a job.

We divide the cows into three groups, incurable, curable and healthy, and advise owner to sell the first group for slaughter. We treat only the group for which there are good prospects of recovery. However, even before we have made the examination of the herd and classified the members as to their mastitis status, for the purpose of record and for information later, we first of all fill out a questionaire with the herdsman or owner. The questionaire deals with everything from the type of milking machine used, the type of feed, to the volume of milk produced and number of calves raised. It gives us valuable information as to how to handle that problem, what caused it etc.

In my opinion the miracle drug for treatment of individual cases of mastitis is yet to be discovered. We believe that the average case of mastitis can be cured with the remedies we now have, but it may not be so easy as it sounds to the dairyman who reads about it in his farm paper. By "cured" we mean the symptoms of the disease have disappeared and the mastitis organisms are no longer present in the udder, so the cow is no more likely to come down with another attack of mastitis than the average cow in the herd which has never undergone a flare-up of mastitis. Some will say of such a cow, "Well, we can infuse something in that cow's udder and clear it up for the time being, but three months from now she will be right back where she is now or in worse shape." I say, "she won't if we treat her properly."

We have tried many drugs. Being at a veterinary college, we have the facilities and I presume it is expected of us to experiment to a certain degree, so that we can give the private practitioner information obtained from our experiments. The drug which was first advocated for intramammary infusion in 1942 still holds top rank as the drug of choice in the treatment of mastitis—sulfanilamide in oil, a home preparation. The sulfanilamide and oil on the commercial market is not recommended. I have never had the privilege of using any of it, that I would use again. Some of the drug companies admit they haven't to date put out a product that they, themselves, would put into a cow's udder. We mix our own sulfanilamide

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in oil, and mixing by any facility that we have at hand. A kitchen "mixmaster" is an excellent piece of equipment to use, and the finished product does not granulate in the cow's udder or settle out so much as do the commercial products that I have used. Of course, I haven't tried them all, but somewhat more than a year ago I purchased a quantity of sulfanilamide in oil from each of six leading drug companies. I tried them all; and threw them all out. They could not be used because either they settled out and caused a concrement at the bottom of the cow's quarter or they were actually so granular and of such a poor mixture, as to cause one to hesitate to put them into a cow's udder.

The method of treatment of the average chronic case of mastitis consists of the infusion per quarter of a dose of 50 to 150cc of sulfanilamide in oil with penicillin. The penicillin to be added to the infusion is first dissolved in as little diluent as possible; *i. e.*, dissolve, *e. g.* 100,000 units in 1cc of water, and inject sufficient of it into the bottle containing the sulfanilamide and oil to make the preparation contain 1000 units of penicillin per cc. In other words, if we infuse 80cc of the final mixture of sulfanilamide in oil with penicillin it would contain 80,000 units of penicillin. This is a safe, non-irritating effective treatment for curable mastitis.

Sulfamerazine and sulfamethazine have been introduced more recently. We have tried them and according to our recent summary (prepared in December, 1947) these newer and more expensive drugs do not stack up any higher, clinically or bacteriologically, over a period than does the old treatment of sufanilamide in oil with penicillin.

The foregoing remarks apply to chronic cases of mastitis. Now, what do we do for the acute cases? In acute cases we like to inject something that will do the job quickly and get out. The drug of choice today, for the average acute case of mastitis, is penicillin in aqueous solution. The amount of diluent that we mix with the penicillin depends upon the volume of udder secretion of the cow. In other words, in a Holstein-Friesian cow, with a large udder, that has freshened recently, we use a small amount of diluent, 10 to 20cc per 200,000 units. If we have a cow with a small udder that is not secreting much, we use a larger amount of diluent, up to 50 or 100cc.

It should be remembered, anything aqueous infused into the udder, is mildly irritating. This is true even of physiological saline solution, hence the smaller the amount of aqueous diluent of the penicillin the better. Then, too there is the factor that the drug injected will be diluted rapidly by the udder secretion, where the latter is large in amount, so the concentration of the penicillin should not be reduced too much.

Whether or not we milk out the quarter depends upon the organism. Because of the acid it produces, some investigators contend the organism most commonly encountered in mastitis, *Streptococcus agalactiae* will eliminate itself if left in the quarter long enough. Who among us would be courageous enough, when we see a swollen quarter, to say to the farmer, "Don't milk her for 48 hours and she will be all right." Actually it will work if the infection is *Str. agalactiae,* but if the infection is a Staphylococcus or a coliform organism, the cow will die long before we get a chance to correct our wrong guess.

Recent experiments have shown that penicillin remains in the quarter in therapeutic dosage longer than we at first believed, therefore, I recommend that an acute quarter be not milked out until at least eight hours after our infusion with penicillin. Thereafter, frequent milking is desirable.

The foregoing applies to the average acute case. In addition to the local treatment one may give orally sulfanilamide or sulfathiazole. In acute cases we do give it; in chronic cases we don't, although I know of practitioners who get comparatively good results from the oral administration of these drugs without the infusion of penicillin.

Now, what do we do for the septic case, the case where we are called in and the cow is nearly dead? She usually has an elevated temperature, though not always; a pulse ranging from 80 to 120 or more and, sometimes, a hurried respiration. We really have a "hot" organism, usually a Corynebacterium, a Staphylococcus or a member of the coliform group. Streptococci alone rarely produce a septic case of mastitis.

These cases are of two classes, (1) those in which the end of the teat is amputated and (2) those in which it is not amputated. In the latter cases we inject penicillin into the udder. Many say, penicillin will not do any good in a swollen, hot quarter and the use of it in such cases is to waste it. We always inject something unless we amputate the teat. Just how valuable the infusion may be at this time I don't know, but in every case I believe it to be of some small value at least. The dose of penicillin given is never less than 50,000 units. It seems a waste of time and penicillin to do otherwise. We give as high as 200,000 units routinely. The cost of penicillin now is such that it is within the range of use for the average case so we can afford to give large doses of penicillin.

Now as to the treatment of toxic cases where there is a systematic effect on the animal from the local infection in the udder. In my experience the one thing that is most important and gives the best results is to place an ice pack on that hot udder immediately. Simply take a burlap bag, tie the four corners, bring cords from the two corners up over the hips of the animal, bring the rear two corners up over the escutcheon and straddle the cow's tail. Tie them all together over the lumbar region just in front of the wings of the ilia. Have the farmer pack ice in the bag. If snow is on the ground, it is even better than ice because it melts more rapidly and thus abstracts more heat. If the farmer will put the bag on and keep it filled with ice or snow for 12 to 14 hours, the results will be actually amazing to one who has never tried it before.

Other treatment for septic cases consists of administering penicillin intramuscularly. Today the preparation of choice is the Romansky formula. This formula contains an extremely high unitage in a small amount of vehicle which is absorbed slowly over a long period. Thus if one million units in 3.5cc of wax and oil (which is the standard Romansky formula) be injected, one is well on the way to bringing the systematic effect of the mastitis to an end.

The sulfonamides such as sulfanilamide, sulfamerazine, and sulfapyridine are used orally. I am dead against prolonged use of any of the sulfonamides other than the intestinal "specifics" such as sulfathalidine, sulfaguanidine and sulfasuxidine. In an infection involving the udder, specifically in a septic case, enough white cells are going to be used up by the infection itself without adding to the burden of producing new cells by overdosing with sulfonamides, which also require white cells to transport the particles about. I have seen animals killed by overtreatment of mastitis and other conditions where they have simply been overdosed with sulfonamides, and the white cells or "defenders" of the body have not been considered and when the overdose of a sulfonamide and the infection destroy these cells, the resistance is lowered to zero and the animal dies. We say the disease killed her, but actually we killed her ourselves.

The next day or even on the first call, an old treatment that we still like is 0.5gm acriflavine intravenously in 500cc of dextrose or saline solution. Acriflavine has an effect against one of our most persistent causes of septic mastitis, the coliform group, against which penicillin is relatively ineffective. Recoveries often border on the miraculous when we use this drug.

Treatment of mastitis during the non-lactating period is popular with the dairyman. The method differs somewhat from that of the lactating cow. First examine the udder carefully. If laboratory facilities are not available, a clinical examination will serve very well after one becomes accustomed to making it. Examine the dry quarters with the strip cup. Any pus that is present is to be considered abnormal. The normal secretion for a dry cow is of the consistency of strained honey. It may be translucent, it may be transparent, or it may be a yellowish, milky color, but it is uniformly syrupy in consistency and looks like strained honey.

If the quarter contains pus and the cow has a history of being a chronic offender so far as mastitis is concerned, we have many drugs that we can use. Large infusions of sulfanilamide and oil are first choice, especially if she can be treated twice during the non-lactating period, preferably at about a two weeks' interval. Say 100 to 150cc of sulfanilamide and oil with or without penicillin. This should be left in the quarter, and the infusion repeated in about two weeks. Where the secretion of milk has not completely subsided and the owner is unwilling to cease milking the cow, have him leave the sulfanilamide and oil in the quarter for two or three days and then milk it out daily, until the secretion is normal. The quarter should not be permitted to fill up with pus. If calving is near and we won't be able to repeat the treatment in two weeks before she freshens, we want a drug a little more "potent" than sulfanilamide. We use tyrothricin (Pitman-Moore). The preparation in oil may be used at a dosage of 40 to 50cc. It irritates the quarter slightly.

If we happen to be on the farm for other than the treatment of mastitis, and the client says, "Doctor, I have a cow here that gave us a lot of trouble when she freshened, or before, and had a mastitis flare-up which about killed her; throughout the year she had had flakes in that one quarter off and on, depending upon the changes in weather. Is there anything you can do for her?" The answer is "Yes." Something can be done for such cases right up until she freshens, and that is to employ the somewhat drastic treatment of infusing the quarter with silver oxide. The commercial preparation that we use is suspension novoxil (Squibb), which is 5% silver oxide. We use from 8 to 10cc of this drug per quarter and no more. The dosage should be small. One can't go dosing this preparation like one would sulfanilamide. The farmer should be told that the quarter will swell up considerably, and will become inflamed and the cow may even go off

feed. He should be informed that such is a normal response and to be expected. If the cow goes off feed, the quarter should be milked out. If she keeps eating regardless of how much the quarter swells, it is safe to leave the infusion in the quarter until the cow freshens.

Two new preparations for the treatment of mastitis are penicillin bougies. They are "mastics" and "penicle." We haven's used either of them very long.

When the bougies first came out they contained only four and five thousand units of penicillin. We considered that dose too small to bother with. Today mastics, a product of the Martin Laboratories, West Chester, Pennsylvania, are available in 25,000 unit dosages, and we have used some with satisfaction. We haven't used a large enough number to be qualified to express an opinion on their value. They are simply a small stick, something like a teat dilator containing 25,000 units of penicillin in an oil-wax base to be inserted in the teat. The advantages claimed for it are the property of being slowly absorbed and of maintaining a therapeutic concentration of penicillin over a long period.

The other new product is marketed by the Wallace Laboratories, Princeton, New Jersey. It has been used somewhat throughout New York State, although at the college we have not used much of it as yet. It is supposed to have the property of releasing the desired dose of penicillin, and holding it in the quarter 36 to 48 hours in therapeutic concentration. Now, if these claims be true, these remedies will be an answer to some of our prayers, because they will allow us to treat certain outbreaks of mastitis satisfactorily with only one or two visits instead of three or four trips per cow as at present. I mention that by way of introduction rather than as a recommendation. We simply haven't proved them, and we don't recommend drugs until we have proved them to our satisfaction. We have tried both the bougies and penicle sufficiently, however, to know they are not harmful.

Various Phases of Dairy Practice*

By C. O. PETRY, M.D.C.
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IN presenting the subject of cattle practice, it is not my desire to stress any particular method of diagnosis or treatment, but to emphasize the importance of careful diagnosis by exacting methods. We older practitioners remember the time when the veterinarian was called only when the usual dose of Epsom salt failed. The present-day cattle owners or herdsmen are more exacting.

Indigestion

Perhaps more calls are made for cattle with some type of indigestion than for any other ailment. Indigestion connotes many different conditions and is signalized by a multitude of varying symptoms due to the fact that the cow possesses a compound stomach and any or all parts may be involved, singly or collectively.

Indigestion may be classified under headings of impaction, acute tympany, atony, gastro-intestinal catarrh, traumatisms, and colic.

The rumen is the part most often affected by impaction. Practically all the cases are preceded by a stage of atony of the muscular walls of the organ, but many cases have passed that stage by the time a veterinarian is called and a definite case of impaction is present.

The most common causes are overfeeding, abrupt changes in feed, improper methods of feeding, indigestible or damaged feed, and insufficient water intake.

The animal shows a loss of appetite, suspended rumination, arched back with more or less curvature of spine away from the left side. In severe cases there is more or less stiffness, occasional grunting on movement, and accelerated pulse according to the severity of the case. In the more simple cases, or any cases of short duration, the temperature is seldom elevated. The pulse and the temperature should be taken in all these cases to differentiate them from the more dangerous types that evince the same symptoms.

Impaction of the omasum is more peculiar in onset. In some cases the onset may be sudden, and resemble a case of parturient paresis; others may be preceded by unthriftiness. In the type where paresis is present, it gives reason for confusing it with milk fever, if it occurs near parturition. These cases, which simulate parturient paresis, brace up when given the usual milk fever treatment, only to relapse. An autopsy will usually reveal acute indigestion in these fatal milk fever cases. I have found the omasum as large as a basketball and just as hard in some cases. It wasn't any trouble to differentiate it from any other compartment of the rumen. By incising the omasum I found a hardened mass even to the extent that it was difficult to pull the folds from the dehydrated content. One could pulverize it in the hands and blow it off the palm.

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It seems strange there could possibly be so much dehydration inside the digestive tract, without showing symptoms earlier than was the case.

The predisposing causes of this condition are, feeding dry, powdery roughage, lack of or insufficient salt and inadequate water consumption. The peculiar thing is why the animal, that shows powdery dry food between the folds of this organ on post-mortem examination, did not show more pronounced symptoms earlier in the attack.

I recall two cases in my first two years in practice. Both were cows down and stretched out. It looked exactly like milk fever, although it was not parturition time. On post-mortem examination we found this dry impaction of the omasum.

Colic

Colic in cattle is a queer but unmistakable ailment and usually indicates a true enteralgia. It may also be due to an intussusception, pyelonephritis, renal calculi or cystitis. When a true enteralgia is the cause, no rise in temperature is present. If symptoms persist, make a more thorough examination for the cause.

Vomiting

Vomiting is a strange phenomenon. This condition is characterized by forcible expulsion of stomach contents through the mouth and nose. Some of these cases are acute and persistent, while others may go unnoticed, but are revealed to the veterinarian by the many eructed cuds that can be found about the premises, before the afflicted animal can be located. It may be due to a derangement of the vomiting center in the medulla, or to an irritation of the nerves in the region of the esophageal opening.

Many are of the opinion that vomiting in cattle is caused by a foreign body in the reticulum. I am of the opinion that every case is an operative one. The foreign body found need not have punctured the wall, but by setting up an irritation it can induce vomiting.

These cases should be taken seriously. A man came to me once and said he had a cow that was vomiting, and I gave him some treatment. He didn't want me to come out and see the cow. I didn't impress upon him the seriousness of vomiting in this animal. The cow got better, but in a few days she had a relapse and I was called. She was in no condition to stand an operation. However, upon the owner's insistence I operated on the cow and found almost one-half handful of metallic material in the reticulum. The cow died of peritonitis, she had a perforation.

Treatment of Digestive Disorders

Treatment of the different types of indigestion varies with the conditions and symptoms. In the more simple cases, where an atonic condition is present, only a stomachic is needed. Avoid dosing heavily with Epsom salt; this is surely a much over-rated drug which we so frequently used in the past. Increasing the dose only serves to weaken the patient, as it acts by abstracting water from the tissues, hence the watery feces.

Water is essential in the treatment of impaction and large quantities can be given through the stomach tube, in cases where the animal does not drink. The desire for water can be increased by intravenous injections of a hypertonic saline solution, or better still, the usual dose of calcium gluconate with dextrose, when the normal chlorides are low. Repeated doses of mineral oil, given *via* the stomach tube, act as a good lubricant, help keep down fermentation, and lessen autointoxication by what appears to be a mechanical action.

If severe tympany is present, relieve it with the trocar or stomach tube. Where it is desirable to keep the cannula in place for a long period, drill a hole in the rim and anchor it to the skin with a small wire thread.

Some animals are what we call chronic bloaters. They bloat upon the least provocation; under the same feeding and pasture conditions that the remainder of the herd tolerate with impunity. Some one has suggested, that inasmuch as rumen digestion is bacterial and not enzymotic, perhaps it is the flora of the rumen which is at fault. It is postulated that it might be a good plan to go to the abattoir and get a large quantity of rumen contents from the paunch of normal animals and pump it into the rumen of chronic bloaters. It was sometime before I tried that one, but when I did get around to giving it a trial the results were surprisingly good.

At times we forget some of the older drugs, which are effective in some of these conditions. I like to go on the old axiom, "Be not the first by whom the new is tried, nor yet the last to lay the old aside." Some of these old drugs that we have relegated to the unused shelves of our pharmacies are still most effectual agents for some disturbances of digestion.

The efficacy of sodium thiosulfate is quite often overlooked. This is an excellent drug to control fermentation as well as a detoxicating agent. The essential oils are good but should be given well diluted, preferably in mineral oil. Lentin has come into prominence and works very well.

Amadon found that barium chloride does not induce contraction of the muscular coat of the

rumen. Surely its frequent use is not justified. Dr. E. L. Quitman, one of the best versed men on therapeutics that I have known, cautioned us as students to avoid the use of strychnine in cattle. I heeded this warning for 30 years, but of recent years it has become a favorite of mine for atony of the rumen in cattle. It should be given orally, in small doses, and often—1.5 grains every three hours. It is not suitable for subcutaneous injection. Used in this way it is extremely dangerous for cattle. Strychnine surely has a use in cattle practice.

There is another old drug that has gained a prominent place in recent months in the treatment of indigestion in cattle. I refer to magnesium hydrate or milk of magnesia. It is given in gallon doses, through the stomach tube. I have seen prompt recoveries from its use, in cases that seemed hopeless.

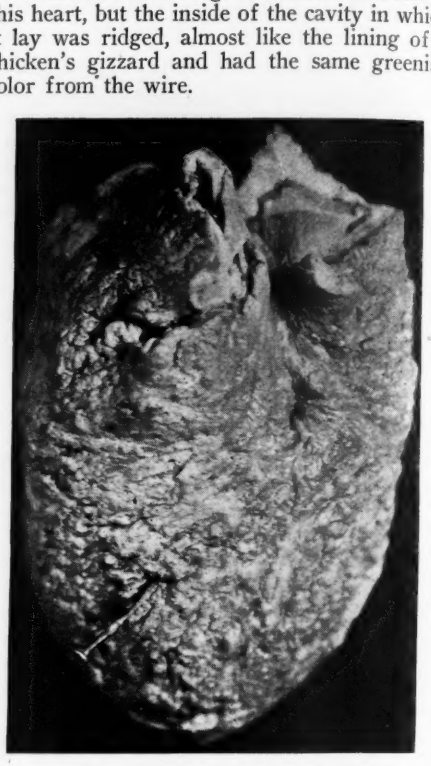
I remember a case that I saw not over three weeks ago, where a cow was on full feed with a bunch of steers. This cow had reached a stage where she was bobbing her head from side to side. When her head was raised, she would drop it down on the floor. I gave her a gallon of milk of magnesia. A second cow that wasn't quite as bad was not treated in this manner and she was the last to recover. This first cow was up the next day and in a few days she was eating again. Just try it.

Trauma

Traumatisms may be circumscribed or diffused. In addition to mechanical injury to the reticulum traumatisms include chronic peritonitis, pericarditis and hepatitis. Percussion, auscultation, pulse, and temperature play an important part in diagnosis. Posture and countenance are quite helpful diagnostic aids. The animal shows stiffness, arched back, pain on percussion, particularly in the region of the ensiform cartilage, and a general tucked-up appearance and a rapid pulse. My "pet" symptom is frequent swallowing. The temperature is quite diagnostic, being usually 104 to 106°F. The prognosis is dependent upon the damage to vital organs.

It is surprising how long a cow can live with traumatic peritonitis or a damaged liver. In one unusual case of traumatic carditis in a cow the heart was impaled on a wire, but the pericardium revealed no evidence of injury.

What was the matter with that cow? All the lymph glands were involved. She was lame in the left fore foot. The cow died in collapse and I held an autopsy, but was still unenlightened. In disgust I struck the knife I was using forcibly into the heart, and hit something metallic. It was a piece of soft, zinc-coated wire, completely buried in the organ, which it had penetrated exactly at the apex. There was no pericarditis present. I have no idea how long that wire had been in this heart, but the inside of the cavity in which it lay was ridged, almost like the lining of a chicken's gizzard and had the same greenish color from the wire.



A case of traumatic pericarditis in which a nail can be seen penetrating the heart

Advanced pregnancy and parturition are common predisposing causes of traumatisms. These injuries are prone to flare up from four to six weeks after freshening.

Acetonemia

The acetonemia complex is perhaps one of the most confusing conditions with which we have to deal. Many other ailments present the same symptoms and clinical picture, such as foreign bodies, metritis, pyelonephritis, and depletion, where loss of appetite, rapid emaciation, and scanty or constipated bowel evacuations are in evidence. The Ross test is a good one for the presence of ketone bodies, but it is far from specific as a test for acetonemia. It shows a reaction in most conditions of malnutrition or continued inappetence. Roepke recommends that the urine be diluted with nine parts of water before making the Ross test, or that the milk instead of urine be used in marginal cases.

Now, don't go out with the idea of diagnosing a case as acetonemia and demonstrating to

the owner by the Ross test that this cow has acetonemia and these other cows are all right. Some of those other cows that are in perfect health will show just as much reaction on the Ross test as the cow in which you have diagnosed acetonemia. That can be embarrassing. I had just about as well depend upon my nose as upon the Ross test, and there is nothing at all the matter with the Ross test. In most cases the breath of a cow, suffering from acetonemia, has a strong, sweetish, chloroform-like odor and sometimes the hide also has this odor.

Acetonemia is a symptom. It is usually seen a short time to a few weeks following freshening in late winter or early spring and more often affecting the heavier producers.

I have not recognized acetonemia in summer among cattle on grass. I may find a positive Ross test in some of these cows, but I am reluctant to call it acetonemia. I believe that no cases of acetonemia occur in the summertime in my section of the country. Getting the animal to consume wholesome food in quantities commensurate with the milk output or other needs solves the problem of acetonemia.

In my hands glandular products and vitamins have been disappointing, in the treatment of acetonemia. Glucose intravenously and chloral hydrate and glucose orally are accepted treatments.

Grass Tetany

We had a seasonable condition develop in our particular part of the state last year, that perhaps was not present in some localities. Our drought was such that our pastures were rather low during the summer and the new crops coming on after the rains arrived developed to a luscious pasture late in the fall. We had a lot of what we call grass staggers among cows on this late pasture. This condition is due to magnesium deficiency. Some of these cases reached a point where the animals walked not only with a staggering gait, but with an arched back. They tried to get their forefeet and hind feet in the same spot. In some well developed cases the animals could hardly walk.

The treatment of this condition, is not without danger, and the same applies to milk fever. I think it is good practice to pay particular attention to the pulse and if indicated, to employ supportive treatment *before* starting the intravenous injection. Metrazol, coramin, or any product containing pentamethalenetetrazol, now marketed by most supply houses, is a good preparation to give before intravenous injection in cases where there is any reason to suspect the heart may not be just all right. If an animal shows distress during intravenous injection, it is my practice to desist immediately and inject the remainder of the solution intraperitoneally. Remember the solutions of both calcium and glucose that we use are of a much heavier concentration than those used in human medicine. They should be given *slowly*. It may save an animal from collapsing from heart block.

Pyelonephritis

This disease, caused by the *Cornebacterium renalis,* was not recognized in this country for many years, but it seems to be becoming common. It may be chronic or acute. In the chronic form the clinical picture may recemble foreign body traumatism or acetonemia since it usually occurs after freshening and often times the urine reacts to the Ross test.

In the acute stage the disease may be confused with the various types of colic, as the animal evinces pain and kicks towards the belly with one or both feet.

The urine may be clear at times, but usually shows cloudiness or is tinged with blood; many times casts are present. Frequent urination is usually present, due to the cystitis which accompanies it. The temperature is generally normal.

The kidneys are enlarged and very sensitive to the touch. My experience has been that the right kidney is more often affected than the left. If the kidney is worse on one side, the animal usually kicks or tramps with the opposite hind foot, perhaps guarding body action on the more painful side. Udall thinks that bloody urine is almost pathognomonic of this disease. Treatment has been very discouraging; the sulfa drugs combined with penicillin in very large doses is recommended by some but penicillin given up to even two and a half million units daily has not given me the hoped for results.

Pyelonephritis originally starts with a mild cystitis, I believe. The organism has to enter the urinary tract some place, so it may enter *via* the bladder. I have seen some of these cases of cystitis where there was a tramping just like in pyelonephritis. In pyelonephritis the animal kicks toward the belly. With cystitis she tramples more or less rather than kicking. I have seen a papillary effusion in the bladder to the extent that it felt like velvet. The best results that I have had are not necessarily from methenamine or urotropin, but from five to 10% solution of argyrol injected into the urinary bladder,; after first emptying the bladder. One gets more complete evacuation of the contents of the urinary bladder by inducing the cow to urinate than by catheterization. After the cow has completely emptied the bladder, inject the argyrol solution, and gently massage the bladder *via* the rectum.

BOVINE STERILITY*

By C. F. CLARK, D.V.M.**
Lansing, Michigan

CONSIDERABLE is known about bovine sterility but a great deal more in unknown. A discussion of it naturally falls into three divisions. (1) The educational angle. (2) That which concerns the owner or handler of the herd and (3) the veterinarian's part in the treatment. These three phases of the solution of the problem of infertility tie in together. If No. 1, the educational phase, is not successful, the herdsman will be unable or unwilling to carry on his part of the program and without his complete and intelligent cooperation, the veterinarian cannot be successful with his part of the program.

The educational phase should, first of all make clear to the cattle owner the economic loss due to sterility, infertility, shy breeding or whatever reproductive inefficiency may be called. Data compiled from the records of the cow testing association in Michigan indicate a 14% turnover of dairy cows, because of reduced breeding efficiency. Therefore, it is important economically. It may very well represent the difference between a profitable business and losing one.

Most of this education is now carried on by the practicing veterinarian. In my opinion it should be a function of the veterinary extension service of the state college. The practitioner is at a disadvantage in this work, because the cattle owner may think he has a selfish interest in advocating it. I feel that a great deal can be accomplished by fully exploiting this educational work.

The herdsman's part in handling bovine sterility is so important that without his complete cooperation there can be no prospect of success. His first duty is to establish and maintain a satisfactory program of brucellosis control. All breeding difficulties are accentuated by Brucella infection. If he has a non-infected herd he should have it tested often enough to keep it that way. If he has a vaccinated herd he should continue the vaccination uninterruptedly till all of the infected animals in his herd have been disposed of by natural attrition. In either case it is important that, so far as possible, he raise all herd replacements. This program of brucellosis control should, of course, be handled with the advice of his veterinarian throughout.

A second matter for the herdsman to handle is the nutrition of the herd. There can be no question that nutrition influences reproduction. It has been my experience that most dairymen feed their cows well but many of them neglect their bulls. If there is any one animal in a herd that deserves the best on the farm, from a nutritive point of view, it is the herd sire. Experience in artificial insemination centers shows that the quality of the roughage influences the quality of the semen. I believe the veterinarian is justified in being adamant in his demand that the herd sire be supplied only the best possible grains and forage before undertaking to handle sterility in the herd.

A maternity stall is another indispensable adjunct to handling sterility that is not always easy to induce the herdsmen to provide. And having provided it, it is sometimes even more difficult to get it properly cared for and properly used. Along with the use of a maternity stall it should be impressed upon the herdsman that any discharge from the genitalia of a cow, persisting three weeks or longer following parturition, is decidedly abnormal and the cow should not be bred until passed upon by his veterinarian. The same should apply to breeding an animal having irregular heat periods. The herdsman is well advised not to let such abnormalities exist for more than a short period, without calling them to the attention of his veterinarian.

Lastly, the owner must of course keep accurate breeding records. The breeding history of an animal is often more significant than the symptoms in arriving at a diagnosis. He should keep such records in a readily available form and in an easily interpreted manner for his own information. He must keep them for the information of his veterinarian, if he is to get maximum value from the veterinary service for which he is paying.

In general outline the veterinarian's part in handling the breeding problems in a herd would include:

1. A realization in the beginning that handling bovine sterility is hard work both mentally and physically.

2. Periodical inspections or check-ups should be planned, in addition to the special trips to the herd at the call of the herdsman.

3. A systematic record should be kept of each animal in the herd showing date and findings of all examinations, all treatments and the breeding record.

4. Pregnancy examinations should be made of all cows at an appropriate period after mating. If the veterinarian is not proficient in

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**State Veterinary of Michigan.

making these examinations and accurate in interpreting them, he should perfect his technic. The information thus obtained is essential to the work and hardly anything else builds up the confidence of the dairyman in his veterinarian so well, as does skill in making and interpreting these examinations.

5. More research into the diseases incident to reproduction in farm animals is urgently needed and it is my opinion that in view of the many unknowns in this field a veterinarian is well advised to adhere rather closely to recognized lines of treatment. There will be enough puzzling cases and enough failures to supply all the experimentation that the practitioner in this field should undertake.

Proposed Foot-and-Mouth Disease Laboratory

Prudence Island, in Narragansett Bay, Rhode Island, has been proposed by the congressional delegation of that state as the site for the U.S. Department of Agriculture laboratory, recently authorized by Congress for research on foot-and-mouth disease. Final selection is withheld, pending consultation with state and local officials and livestock interests. The proposed site meets the specifications of the Congress, which directed that the research on this disease be conducted on a coastal island separated from the mainland by deep navigable water. It also fulfills the recommendations of Department officials that the site be suitable for the extensive buildings needed, that it be reasonably near other scientific institutions to facilitate consultations and library service, and that it should not be so isolated as to prevent the procurement and retention of qualified scientific personnel.

The Prudence Island area of several square miles is ample for the 500-acre research establishment needed for proper isolation of the buildings and experimental animals. The nearest point on the mainland is about two-thirds of a mile from the island. Several large universities and scientific institutions will be conveniently accessible to the laboratory staff. The Island's sheltered location in the bay protects it from storms and facilitates ferry service. In several other respects, Prudence Island fulfills the desired combination of essential requirements more fully than other available locations that have been proposed to the Department.

The laboratory, for which sketch plans have already been drawn, will be the largest and most complete of its kind in the world and will have a staff of at least 300 employees.

Department officials estimate that the preparation of detailed plans and other essential arrangements for the laboratory will require approximately a year. The probable cost for buildings and research facilities will be between $25,000,000 and $30,000,000 and yearly operating expenses $2,500,000 and $3,000,000.

The purpose of the research to be undertaken is to increase present knowledge of the disease, thereby helping to prevent it and assure ample national production of meat, milk, and other livestock products. In addition, knowledge developed through veterinary research often has eventual value in human medicine.

Vaccination Against Foot-and-Mouth Disease Increasing

As a safeguard to the foot-and-mouth disease quarantine lines, and also as a promising means of gaining ground against the disease, the control forces have vaccinated more than 100,000 susceptible livestock. The vaccine thus far available has been applied in strategic locations where most needed. The general strategy calls for the establishment, as soon as supplies of vaccine permit, of a belt of vaccinated animals in each buffer zone. Such barriers, of animals highly resistant to the infective virus, the officials point out, may eventually be widened in the direction of the infected area, thereby further reducing its size.

Johnson Appointed to Foot-and-Mouth Disease Work

Harry H. Johnson, Houston, Texas, has been appointed special assistant to the U. S. Secretary of Agriculture and will be responsible directly to the Secretary for the administration of the Department's foot-and-mouth disease program in cooperation with the Republic of Mexico. In addition, he will be a consultant to the Chief of the Bureau of Animal Industry.

Mr. Johnson has had extensive experience as a business executive and is now on loan to the Department. In his new administrative duties he will maintain offices in both Mexico City and Washington, D. C. The appointment was made after consultations with Mexican officials both in diplomatic posts and in the joint commission that is conducting the campaign against the disease. Such an appointment has been urged by congressional leaders and several livestock groups as a means of reducing the administrative responsibilities of the technical staff and thereby increasing the effectiveness of the campaign.

Observations On Livestock Feeding*

By LYMAN PECK
Chicago, Illinois

IF any of you folks came here today expecting to hear an academic lecture on nutrition, you will be disappointed. Instead, the discussion will be about some of the nutrition problems encountered in every day veterinary practice.

Although not a veterinarian, I am fortunate in having many friends among the profession, as a result of close contact with veterinarians for over 35 years. During this period I have had occasion to do a lot of trouble shooting among farmers who imagined the feed was killing their livestock and poultry. So much for the background.

The primary function of a veterinarian is to be able to correctly diagnose the cause of disease losses. Obviously a correct diagnosis must be made before intelligent treatment can be instituted, otherwise treatment is like shooting in the dark. There are plenty of farmers who reverse the process and start treatment first, and after trying everything from kerosene to Lydia Pinkham's Compound, call a veterinarian as a last resort. At that stage it is a magician they need.

This matter of making an accurate diagnosis is often very complex. It requires technical knowledge, experience, the ability of a Sherlock Holmes, patience, and considerable diplomacy and common sense. In other words, the veterinarian has to be a diplomat, a detective, and a good public relations counsel in addition to possessing professional ability.

Nutrition and Disease

The more we study nutrition, the more we are bound to realize how closely it is associated with many of the diseases of livestock; how resistance to disease may be lowered by protein, vitamin and mineral deficiencies. Many of the failures in reproduction are directly due to the same cause.

Because of this, the problem of making a correct diagnosis is rendered more difficult, if one does not possess a good working knowledge of nutrition. Without this, it is so easy to arrive at erroneous conclusions and diagnose a nutritional deficiency where it does not exist. This usually causes trouble for all concerned. Let me cite a few examples of this.

A farmer's cows were sick. They had bloody diarrhea. A veterinarian was called. His diagnosis was "protein poisoning" and he advised taking the protein supplement out of the ration and feeding ground ear corn and oats with hay. Quite naturally the farmer complained to the feed manufacturer because he was feeding a commercial 34% dairy supplement. Now here are the facts with regard to the feed. The farmer had mixed 100 pounds of 34% protein supplement with 500 pounds of ground ear corn and ground oats. This would make a mixture of about 12 to 13% protein. Of this he was feeding about two pounds to each cow twice a day—a total of not over 4 pounds per cow per day of a 12 to 13% protein feed. The feed manufacturer then called on the state veterinarian, and told him the story, and to his surprise found that he too felt that this bloody diarrhea was a result of protein poisoning.

Many years ago, Dr. C. F. Huffman of Michigan State College, tried to find out how much soybean oil meal he could safely feed to a cow. He took two Holstein-Friesian heifers with their first calves and fed them 18 pounds of soybean oil meal per head per day for over four months. The remainder of the diet was hay. The protein content of the soybean oil meal was 46%. There was no harmful effect; nor did they scour. I saw these heifers at the time they were on trial. He also fed 17 pounds of cottonseed meal per day to another cow along with sufficient vitamin A, with no adverse results. He does not yet know how much soybean oil meal it takes to injure a cow because he could not get them to eat over 18 pounds daily. He does know from this and other experiments, that so-called "protein poisoning" is a myth.

Note the comparison: 18 pounds of 46% protein feed per cow per day with no harmful effects, and four pounds of a 12 to 13% feed per cow per day resulting in protein posioning!

In another instance in Indiana, a feeder changed brands of protein concentrates for his hogs. Being a careful feeder, he mixed the concentrate with the grain, making a feed of about 12% protein. Before the change he was feeding a 16% protein mixture. Some of the pigs became sick and a few died. A veterinarian was called, and immediately diagnosed "protein poisoning." The farmer was not convinced and called another veterinarian. The second one examined the feed and the self feeders carefully. It had rained, the feeders were not protected, and the feed was wet and moldy. The moldy feed was removed and fresh feed—the same mixture—placed in the feeders. No more trouble was experienced.

Had the first veterinarian examined the feed and the feeders carefully, he would easily enough have discovered what was sickening the

pigs. If he had figured the protein content of the mixture, he surely would not have made such a snap diagnosis.

So-called "protein poisoning" is the cause of much friction between veterinarians and the feed industry. It suffices to say that Huffman, Schalk and others have demonstrated there is no such thing as protein poisoning. Statements to this effect have appeared in your literature repeatedly.

Prof. Robison at the Ohio Agricultural Experiment Station has tried, repeatedly, to produce protein poisoning in swine. In the first test, he fed four pigs nothing but a 40% protein ration for 13 weeks. At a veterinary meeting here in Indiana in 1939 the pigs and viscera after slaughter were exhibited. Although over 400 veterinarians were present, not one could find any evidence of protein poisoning.

Later on Robison fed several groups of pigs rations containing from 9 to 52% protein from about 60 pounds to market weights. The poorest group were those which were fed the 9% protein ration. The others up to and including the groups on 40% protein did well. They gained more than a pound per day. Even the lot on 52% protein did well. Upon autopsy there was some evidence of kidney enlargement in the lot on 52% protein; none in the others.

From this and other carefully controlled experimental data, the conclusion would seem to be, that protein poisoning should be classed with two other more venerable but wholly mythical diseases "hollow horn" and "wolf in the tail."

Protein Deficiency

On the other hand a protein deficient diet for pigs may not only decrease growth and feed efficiency, but may also interfere with normal disease resistance.

Dr. Paul Cannon of Billings Hospital, University of Chicago, found that a certain group of their patients (human) suffered from postoperative infections. In an attempt to ascertain the cause he and his co-workers ran tests to determine the protein content of the blood serum. They found it was around 4% in the infected group, whereas normally it is about 7%.

It is well known that antibodies are protein in nature. Therefore, if there is a deficiency of protein, the production of antibodies is subnormal—a thought for your careful consideration. It might be a good idea to run some experiments vaccinating pigs against hog cholera. Take two groups of pigs, one with a normal blood serum protein, and another sub-normal. This should be done under carefully controlled conditions. It is not practical to make such blood determinations in the field, but it is practical to check the protein content of the ration of pigs prior to vaccination, to see if they are getting enough protein. This is mentioned because frequently there are cases where a veterinarian has advised farmers to reduce the protein content of the ration—take the protein supplement away from pigs prior to vaccination. It is possible in view of Doctor Cannon's work that he may be doing just the opposite of what he intends.

Animal Versus Vegetable Protein

In the early days before much was known about water-soluble vitamins or minerals, many tests were run to determine the value of animal by-products—meat scrap, tankage, fish meal and dried milk—versus proteins of vegetable origin such as soybean oil meal, cottonseed meal and linseed meal. Most of these tests were made on chickens. As a rule, the animal protein feeds produced best results, and the conclusion was that this was due to the superior properties of the animal protein. Now the fact is, no attempt was made to make up the difference in vitamin and mineral content. Protein got all the credit. As research progressed it was found that proteins of animal origin contained larger amounts of calcium and phosphorus, and also a greater amount of water-soluble vitamins such as ribo-flavin, niacin, choline, etc.

When these minerals and vitamins were added to a ration containing only vegetable protein, the results were quite comparable to those obtained from animal protein. Hence, meat scrap, tankage, fish meal and milk products should not be considered as protein sources alone, but as sources of vitamins and minerals as well. When animal proteins are replaced by vegetable proteins, these vitamins and minerals must be added. All this is well known to the students of nutrition in the feed industry and, of course, to most veterinarians.

Animal Protein Factor

The more recent experiments have indicated a factor in proteins of animal origin that has not yet been completely isolated, and identified. It is referred to as the "animal protein factor" which is a misnomer because apparently it is not an amino acid. It apears to be a water-soluble vitamin and, as Dr. H. R. Bird at Beltsville says, "It apparently influences protein metabolism."

This animal protein factor is found in the greatest concentration in condensed fish solubles. Fish meal and liver meal are good sources, and fair sources are meat scrap, tankage and milk by-products.

Doctor Bird and others have found dried cattle manure to be a good source. Bird has

made a water and alcohol extract from cattle manure concentrated to such an extent that .004%—1.25 ounces per ton—is sufficient to produce excellent results on chick growth when added to an all-vegetable protein ration. Another evidence that this is important, is the fact that this factor is carried through the egg to the newly hatched chick, and influences its early growth materially.

Whether this is the same factor that is being studied in the gestation and lactation rations of dogs, so far has not been proved. It is quite probable that it is.

Fairbanks and Krider at the University of Illinois, Bohstedt in Wisconsin, Catron in Iowa, and others, may be working with the same factor in their studies on gestation and lactation rations for sows in dry lot and in growth studies on young pigs.

Feeding Ruminants

During the past few years, research on the feeding of ruminants has taken a new approach and is concentrating on a study of the bacteria in the rumen. Huffman at Michigan State College, and Gerlaugh, Burroughs and their co-workers in Ohio are making excellent progress.

It should be realized that the rumen is a vast fermentation vat. Here the bacteria play an important part in the digestion of feed. A brewmaster in a brewery, or the chemist in charge of a distillery, can explain about fermentation *in vitro*—how yeast cells are fed and how sensitive these organisms are to temperature and the pH of the media in which they grow.

Temperature of Drinking Water Important

On many farms the cattle get cold or even ice water to drink twice a day. Burroughs working with cattle with rumen fistulas, found that whenever they drink cold water it takes about three hours before the temperature of the rumen content returns to normal. That means these fermentation bacteria go on a sit-down strike until the temperature rises. If this happens twice a day it seriously interferes with digestion. This should be explained to clients and they should be assured that a water heater is not an expense but a necessity in wintertime.

Now consider the matter of pH. A cow secretes the equivalent of three-quarters of a pound of sodium bicarbonate in her saliva every 24 hours. In addition to acting as a lubricant, saliva has another purpose for, being alkaline, it helps to maintain the proper pH in the rumen. Nature maintains this just like an automatic carbureter. That is, She does unless some one comes along and throws it all out of adjustment by introducing a whole pound of baking soda or some other alkaline material into the rumen. That, too, causes the bacteria to go on a sit-down strike for a while, thus slowing down digestion. It may be necessary, occasionally, to dose a cow in this manner, but surely it should not be continued for any considerable period. The same thing applies to continued feeding of such alkaline substances in appreciable amounts, which may change the normal pH in the rumen.

If there is an understanding of how to feed the bacteria in the rumen, much will have been learned about the feeding of ruminants—probably a better understanding of bloat will result.

Trace Minerals

More and more is being learned about the requirement of ruminants for cobalt. Apparently the cobalt is primarily needed for the proper development of the bacteria in the rumen. Originally the deficiency was recognized in Florida. Then in Northern Michigan. Later on it showed up in the herd at Michigan State College. New Hampshire has found it, and it was recognized in sheep in Wisconsin. It occurs in various parts of the world and may be more widespread here than we think.

Iron, copper and manganese, are likewise being studied. Huffman believes an occasional deficiency of magnesium occurs in Michigan. It is for these reasons that many feed manufacturers are including these trace minerals in their feeds and supplements. It is good insurance and the cost is very small, 10 to 15 cents a ton.

Salt

The excellent work reported by Vestal and his associates at Purdue, on the feeding of salt to swine should be studied. Salt should be fed free choice to swine. Regardless of whether a mineral mixture is added to the ration it seems advisable to keep it before hogs and cattle—where they may have access to it at all times. Do not add the salt to the mineral mixture; feed each separately. The Morton Salt Company has published some excellent data on salt requirements. The Purdue studies and some at the University of Wisconsin and by Graham in Illinois indicate that salt poisoning in swine is pretty hard to produce, either by feeding loose salt or brine free choice, especially if the hogs have access to water. Believers in salt poisoning may get a change of heart from studying this experimental data reported by Vestal. He tried to kill pigs with salt and brine, and they would not consume enough to even make them sick.

It is difficult to change one's mind about

something one has believed for many years. Opinions are all right, but facts established by experimental data are far safer guides. One should depend more upon experimental data obtained under properly controlled conditions than upon opinions.

Vitamin A

At the Cornell Nutrition Conference a few years ago, Doctor Guilbert of California, who has done extensive experimental work with vitamin A and carotene on livestock, when questioned about the first symptom observed in his experiments in depleting hogs of vitamin A and carotene, answered, "A peculiar incoordination in gait in the hind legs resembling posterior paralysis due to mineral deficiency."

This is mentioned because many such cases occur in the field where the two are confused. Of course, goose stepping (spastic paralysis) occurs as a result of pantothenic acid deficiency—just to complicate the whole matter of diagnosis.

Frequently, one notes cases of vitamin A deficiency in cattle being fed hay that is one or two years old. Inasmuch as it takes roughly three units of A from carotene to equal one from true vitamin A oil for four-footed animals, it seems that shark oil capsules of 10,000 to 25,000 units of A should prove to be a good addition to one's stock of drugs. They may also be used for young calves that do not receive colostrum from their dams.

Losses of Suckling Pigs

As to the losses among suckling pigs, a report entitled "Save More Pigs" just released by the American Veterinary Medical Association and the American Feed Manufacturers Association, follows:

SAVE MORE PIGS

Extensive surveys indicate that 40% of the pigs farrowed fail to live to weaning age.

Profitable hog production demands a reduction of this wasteful mortality. It is a waste of feed and labor as well as potential profits.

These losses are felt by the farmers, feed manufacturers, and veterinarians. Indirectly they affect the meat packers and every consumer of pork products.

The excessive pig losses in the spring of 1947, again emphasized the need for specific measures to reduce this mortality.

This suggested a cooperative attack on the problem and a conference was sponsored jointly by the American Veterinary Medical Association and the American Feed Manufacturers Association, in May of 1947. Since that time a series of conferences have been held. Representatives of all phases of swine husbandry attended.

Experts in swine management, disease prevention, and nutrition were called in from Agricultural Colleges, U.S. Department of Agriculture, and from industry. They pooled their information and divided into two groups. One concerned with disease and the other managament and nutrition. The committee on management and nutrition, makes the following recommendations:

1. Use good sanitation practices to prevent worm infestation and filth-borne diseases in young pigs. Clean sows, clean farrowing pens and clean yards or pasture, from the standpoint of disease and internal parasites, are most important.

2. Make maximum use of good green pasture for sows and gilts during pregestation, gestation and lactation periods, whenever possible.

3. Permit bred sows to have free range of pastures and harvested crop fields during winter gestation, whenever possible.

4. Whenever green pasture is not available, the total ration for pregestation, gestation and lactation should contain at least 10 to 15% of high quality alfalfa meal or ground green leafy alfalfa.

5. Include oats, wheat middlings or similar feeds with corn and supplements in the gestation and lactation rations of sows and gilts.

6. Consistently use an efficient protein supplement with necessary vitamins and minerals in rations of bred sows and gilts—one-half pound, or more, of the supplement per sow daily, the amount depending on its protein content, the age of the

The excessive losses of young pigs affect the farmer, the feed manufacturer, the veterinarian, the meat packer, and the pork-consuming public. Research in swine management, nutrition and disease prevention is being prosecuted to reduce pig losses.

sow, and the amount of alfalfa meal or pasture used. Follow directions carefully when using manufactured feed.

7. Always give bred or lactating sows and young pigs free access to salt. Use stabilized iodized salt if stabilized iodine is not included in the mixed feed or supplement.

8. Give sows and pigs free access to a good mineral mixture, if supplementary minerals, especially calcium, phosphorus and salt, are not otherwise adequately supplied in the ration.

9. Avoid abrupt changes in the ration of sows before farrowing. When sows are penned for farrowing, reduce the gestation ration slightly, and prevent constipation by adding a handful or more of linseed oil meal or wheat bran to the ration twice daily.

10. Do not overfeed the sow immediately before or after farrowing. Full feeding of sows before the pigs are a week old may result in caked udder or mastitis, and heavy losses of newly-farrowed pigs.

11. Provide dry, warm farrowing pens and houses that are well ventilated and free from drafts. Use electric pig brooders or other means of temperature control to save newborn pigs in cold weather. Heated pig brooders usually save one or more pigs per litter. Guard rails will reduce pig losses from overlaying, especially when brooders are not used.

12. Prevent anemia in pigs confined away from the soil by keeping a chunk of uncontaminated sod in the farrowing pen, starting when the pigs are one to two days of age and continuing until they are old enough to eat grain or other solid feed. An iron sulfate (copperas) solution applied to the sow's udder daily also is effective.

13. Ear mark litters for identification in the selection of future breeding stock, and for segregation in case disease makes isolation of the litter necessary.

14. Creep-feed suckling pigs to reduce injuries and death losses.

15. Keep sows, gilts, and pigs free from lice and other external parasites to promote better health of the animals and prevent spread of disease.

16. Boars and gilts should be at least eight months of age and well developed before being used for breeding purposes. Select replacement boars and gilts from the best litters.

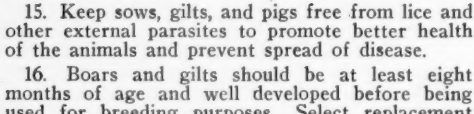
17. Avoid purchasing bred sows or sows with litters in the usual community sales barns, and the hauling of sows and litters or feed in disease-contaminated trucks.

18. Do not hesitate to write to the College of Agriculture of your state for information on swine feeding and management.

Diagnosis

Nursing pigs may die from these recognized diseases: brucellosis, transmissible gastroenteritis, acute uremia, erysipelas, hog cholera, pneumonia, omphalitis, parasitism as well as some diseases not yet identified. This is further complicated by results of mismanagement and nutritional deficiencies.

In making a diagnosis the well-trained, experienced veterinarian often faces a difficult problem. The untrained man an impossible one.



To Avoid Heavy Losses

1. Watch the pigs closely.
2. At the first sign of trouble consult your veterinarian immediately, delays are costly.
3. Do not attempt any treatment until a correct diagnosis has been made.

In addition an excerpt from a letter by Walter C. Berger, President of the American Feed Manufacturers Association, to all members of that association under date of August 19, 1947, is of interest:

"But—more important to feed manufacturers—this conference brought out and emphasized two very pertinent facts:

1. That baby pig losses were due to many causes and that the so-called "new baby pig disease" was responsible for only a small percentage of the losses.

2. That determining the causes of pig losses is a very complicated procedure for even top-ranking veterinary authorities, which again proves the contention of the American Feed Manufacturers Association, that diagnosis is a job for qualified veterinarians ONLY!

This is an example of the useful information that results from cooperation between associations such as the A.F.M.A. and the A.V.M.A. But to get full value from such information, our cooperation must be carried out to the field—to every farming community.

Therefore, the A.F.M.A urgently recommends that every feed salesman and service man should make it his business to become personally acquainted with the veterinarians in his territory, and that "he should recognize that diagnosis is always a job for the veterinarian."

In closing I wish to make clear that practitioners are not always responsible for the friction that sometimes occurs in their dealings with the feed industry. There are plenty of cases where the feed man is to blame as well as his feed. Sometimes it is the farmer himself who has a good, well-balanced feed, but fails to follow feeding and mixing directions. Cases are not unknown where even the feed man have attempted to use the veterinarian to alibi for the deficiencies in his product. No, it is not all one-sided.

If the feed men and the veterinarians would get better acquainted, as Mr. Berger suggests, they could be very helpful to each other and working together, they can better serve the farmer with his livestock problems. Tolerance, open minds, and courtesy are the grease that makes the wheels of progress roll smoothly. That, my friends, is good public relations.

WHENCE AND WHITHER?*

By JOHN G. HARDENBURGH, V.M.D.**
Chicago, Illinois

THE motion picture, "Valiant Years," which you saw this morning, telling the story of about 50 years of a veterinarian's life, seems a good introduction for what I wish to discuss, namely, nearly *twice* 50 years of veterinary medicine in America.

Doctor Merillat says that veterinarians aren't interested in the history of their profession, but I hope you will bear with me while I present a few figures to show something of where veterinary medicine, and particularly veterinary education, in North America has come from in the past hundred years and, perhaps, get an idea of where we are going. Hence, the rather obscure title of my remarks, "Whence and Whither?"

Actually, veterinary medicine has existed in North America in an organized way for not quite a hundred years, but it is getting close to that period. The first veterinary college was chartered in 1852 in Philadelphia, and two years later the Boston Veterinary Institute was organized. Neither school, apparently, had any graduates of record. But, starting in the early 1860's, when there were two, and later, three schools operating during the decade 1861-1870, with the first graduate of record in 1865, the progress made in the establishment of veterinary colleges in the United States and Canada, the number of graduates by decades, the veterinary population of the United States, and the growth of membership in the American Veterinary Medical Association is shown in Table I.

The figures for the veterinary population, starting with the decennial census of 1870, are those reported by the Federal Bureau of Census, but that of 500 veterinarians in the United States in 1860 is a guess. The 1,171 veterinarians listed in the census of 1870 probably does not represent only graduate veterinarians, because up to 1870 our own schools had graduated only 40. Of course, a number of graduates of foreign veterinary colleges had come to this country in the early years. The number of these has decresaed greatly in recent times, but the end of World War II has witnessed a greatly increased effort by foreign-educated veterinarians to immigrate to the U.S.

The figures in the table are significant, I think, as they indicate the development of new veterinary schools, particularly up to and including the decade 1901-1910, at which time there were from 17 to 21 colleges in the United States and Canada. Of the schools in operation during the decade, about 10 were so-called private institutions. The principal private schools were most important in furnishing much of the veterinary personnel of this country as we know it today. Without those schools, our veterinary service would have been even more delayed in development and would, even now, be weak and inadequate.

Entrance to the School of Veterinary Medicine, University of Pennsylvania. In 1808, Dr. Benj. Rush, head of the medical school, urged establishment of a veterinary school in the university. This was the first suggestion of a veterinary college in U. S. Doctor Rush's recommendation was adopted—76 years later.

As you know, most of the private colleges closed during World War I or shortly thereafter, so that, in the deacde 1911-1920 the number of veterinary schools decreased about one-half. In that decade, however, the peak in the number of graduates (7,445) was reached. It can be seen from the figures what happened after World War I.

The horses was passing from the scene, several schools closed, and enrolment at the remaining colleges declined to such an extent that there were less than 1,800 graduates in the decade 1921-1930. These factors largely accounted for the shortage of veterinary personnel which became acutely apparent at the be-

*An address at the annual meeting of the Indiana State Veterinary Medical Association, January 15-17, 1948.
**Executive Secretary American Veterinary Medical Association.

ginning of World War II. Also, the number of graduates in the decade 1901-1910 (5,207) and in 1911-1920 (7,445) comprised such a a large proportion of our over-all crop of veterinarians that we went into the last war with a high average age, nearly 50 years. It appears that too many of us are of the "vintage" of 1901-1920.

The downward trend in graduates continued until the early 1930's, at which time the enrolment at the accredited veterinary colleges started to climb and has risen ever since. Thus, the number of graduates (3,500) in the decade 1931-1940 was double the figure for the previous 10 years.

According to the official census figures, the high point in our veterinary population was in 1920, at which time it was reported as nearly 14,000. Most of these can be assumed to be graduate veterinarians, although there were and still are some non-graduate, licensed practitioners. The census figure went down in 1930 and again in 1940. Did the profession really lose a considerable number of veterinarians, or did many of them enter other lines of work in the "depression" years? We don't know, but in any case Uncle Sam's census of 1940 showed less than 11,000, a reduction of almost three thousand from the 1920 peak. I question the accuracy of this figure.

For 1947 we have estimated the number of veterinarians in the United States to be 14,000 which we believe is close to the true figure. From 1947 to 1950, in order to fill out the decade, we have done some more guessing as to graduates, and total veterinary population, setting the latter at 15,000 for 1950.

Now, something about the schools: I think you know that there are seven new veterinary colleges in this country, including the one for Negro students at Tuskegee Institute. Others have been authorized or established at the universities of California, Georgia, Illinois, Minnesota, Missouri and Oklahoma. The Tuskegee school is now in its third year and has freshman, sophomore and junior classes. Georgia and Missouri are in their second year with freshman and sophomore students; Minnesota has its first freshman class. The actual openings of the schools at California, Illinois and Oklahoma have not been announced.

With the vastly increased enrolment at existing accredited colleges plus the prospective crop of graduates from the new schools, it is estimated that there will be about 7,000 veterinary graduates in the decade 1941-1950, a figure still below the peak decade of 1911-1920.

As you can see from the figures, A.V.M.A. membership lagged far, far behind the veterinary population of the country for many years. Established in 1863, it was not until World War I that a concerted drive brought the membership curve up sharply. A large number of veterinarians answered the pleas of Dr. Haring and Dr. Merillat who were A.V.M.A. secretaries in 1915-16 and 1916-17, respectively. Moreover, nearly every veterinarian who entered the Veterinary Corps during the first war (there were over 2,000 veterinary officers on active duty in 1918) apparently thought it was a good idea to belong to his national organization.

In the last two decades, A.V.M.A. membership has grown rapidly. A considerable proportion of this growth can be attributed to the student chapters in the accredited colleges, a large percentage of whose members join the association at time of graduation. If the figures in the table were plotted, the graph would show that in each succeeding year the line representing A.V.M.A. membership approaches more closely the line for the total number of veterinarians in the United States. This is as it should be; the national organization, in order to be a going concern, can't operate properly if it represents only a minor-

TABLE I.—NUMBER OF SCHOOLS, GRADUATES AND VETERINARY POPULATION OF U.S.A. AND A.V.M.A. MEMBERS BY DECADES

Decade	No. of Schools	No. of Graduates	Veterinary Census		No. A.V.M.A. Members
1851-1860	2	0	500	(?)	—
1861-1870	2-4	40	1,171	('70)	100
1871-1880	5-7	402	2,130	('80)	100 (?)
1881-1890	9-14	1,644	6,494	('90)	200 (?)
1891-1900	15-20	2,943	8,163	('00)	650
1901-1910	17-21	5,207	11,652	('10)	1,350
1911-1920	25-15	7,445	13,494	('20)	3,800
1921-1930	15-12	1,793	11,863	('30)	4,500
1931-1940	13-12	3,468	10,957	('40)	6,200
1941-1950	12-19	7,000 (?)	15,000 (?)	('50)	11,000 (*)

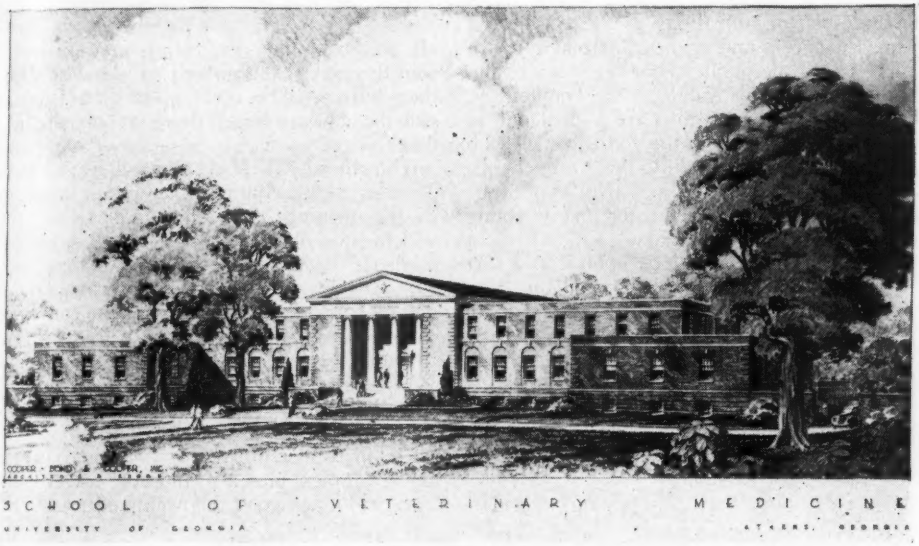
(*) As of August 1, 1947, 9,256.

ity, or even a bare majority of the veterinarians; much the same thing applies to state associations. There are about 600 veterinarians in Indiana of which, I believe, about 300 belong to your state association.

In this and other state associations during the past few years, I have heard proposals for or discussions about raising dues in order to obtain the funds needed for expanding activities. It is obsolutely necessary, of course, that veterinary associations be in good financial condition. Increasing the annual dues is often-

perform veterinary services of one kind or another and has even affected the sales policies of some large manufacturers and distributors of pharmaceutical and biological products.

The best answer to this situation is the type of service rendered by veterinairans in their communities. Capable veterinarians need not worry too much about the drug store, feed dealer, or somebody else selling so-called animal health products to farmers and livestock owners. You, as graduate veterinarians, can render services for which druggists, feed deal-



School of Veterinary Medicine, University of Georgia

times the first solution that is considered when more funds are needed, but, unless a concerted effort has already been made to build up the membership, or, unless the association already numbers among its members a good majority of the eligible veterinarians, it is highly desirable, in my judgment, that the latter objective be attained first. After that, if circumstances require, increase of annual dues is certainly warranted. Taking the A.V.M.A. as an example, I would much rather see 10,000 members paying dues of seven dollars than 7,000 members paying 10 dollars, the dues income in either case being the same; I feel that our basic strength is in numbers rather than in dollars, and in selling the value of A.V.M.A. membership to the greatest possible number.

The small number of veterinarians in this country has been a real handicap in expanding veterinary services in the last 15 or 20 years, and the acute shortage which developed prior to World War II is even more serious, in my opinion. It has invited unqualified persons to

ers and others are not equipped. You have the training, skill and diagnostic ability so fundamental to proper treatment. You can always do a better job than the untrained person who is inclined to get off-base and be sold on the idea that he can profit by attempting to diagnose and prescribe for animal diseases.

With respect to feed dealers, particularly, I believe, in the long run, there is not so much to worry about. Knowing the policies of the American Feed Manuafacturers Association, I know that feed dealers are not being encouraged to mess into animal disease matters from the top level of the feed industry. The feed dealer and the veterinarian are serving the same client, the farmer, whose best interests are their mutual concern. Hence, the veterinarian and feed dealer have common ground for understanding and cooperation.

Unfortunately, an undesirable condition exists in some segments and in some of the top policy-making levels of the pharmaceutical industry. Ever since 1942, there has been an

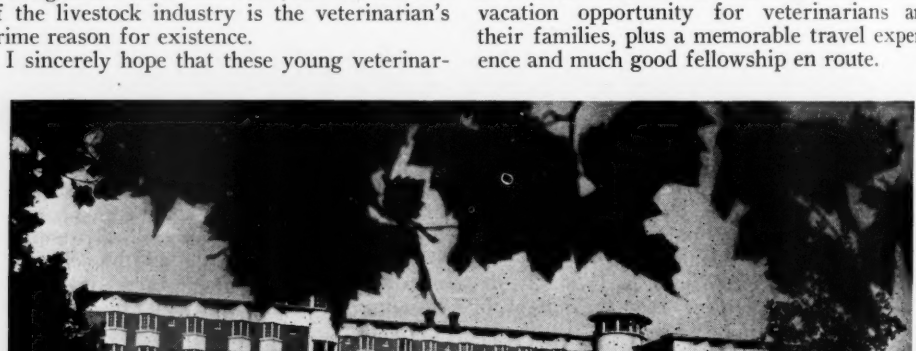
all-out effort by the drug industry to sell the druggist on the idea of dispensing all "animal health products." The concept inevitably leads to attempts at "counter" diagnosis and prescription. It should not be contenanced because it is so obviously and fundamentally wrong and is contrary to the long-term welfare of the livestock industry. In my opinion, the truly professional pharmacist and druggist will not get mixed up in this sort of operation.

The A.V.M.A. public relations program is being expanded each year. Did time permit I should like to discuss it in some detail. It is fine that such organizations as the Associated Serum Producers and agencies of that sort are helping to tell the public about the work of the veterinarian and his value to the communtiy. These educational programs are a challenge to all of us and especially to the younger men who are entering the profession today. Our schools, as you know, are overwhelmed with applicants, and I sometimes wonder if too many young men now seeking veterinary medicine as a career are not inclined to look upon it as a sort of "bonanza" profession. It is true that veterinarians, like many other professional men, are prosperous today, perhaps as never before. I hope they continue to be. But veterinary medicine is primarily a *service* profession. It used to be said that the veterinarian had nothing to sell but his services, and the welfare of the livestock industry is the veterinarian's prime reason for existence.

I sincerely hope that these young veterinarians do not gain a wrong impression from the times; that they will realize their professional responsibilities first, last, and always; that whether they make a big pocketful of money the first year or two, is not the important or lasting measure of their success. Instead, their first objective must be to prove their capabilities and to become soundly established in their communities and render a good service.

In closing, I want to say a few words about the San Francisco convention next August. An attractive vacation trip for veterinarians, their wives, families and guests is being planned. We hope you will start planning now, first of all, to go to the convention and, second, to join the special tour which will be described in the *Journal*. The meeting in San Francisco will be outstanding; there is no doubt of that.

The official A.V.M.A. tour will leave Chicago Monday night, August 9, one week in advance of the opening of the meeting. Going, there will be stop-overs in El Paso with sidetrips to Carlsbad Caverns and Juarez, Mexico, and in Los Angeles, arriving in San Francisco Sunday morning, August 15. After the convention, there will be three choices of return routes through the scenic Northwest: the Canadian Rockies, Lake Louise and Banff; Glacier National Park; or Yellowstone. The tour will take about two weeks and will offer a rare vacation opportunity for veterinarians and their families, plus a memorable travel experience and much good fellowship en route.



Dormitory in l'Ecole Nationale Vétérinaire d'Alfort. This school, the second to be established in modern times, was founded in 1765

Differential Diagnosis in Swine Diseases*

By R. M. HOFFERD, D.V.M.**
Grand Rapids, Iowa

THE field of swine diseases is so extensive that this discussion must be limited to the most devastating and perplexing diseases only.

Hog cholera is still the arch enemy of the swine-raising industry. The differential diagnosis of all communicable diseases center around it. It is classed as an incurable but preventable disease. It must be detected in the incipient stage to save the herd from disaster. In this stage, it is often detected with great difficulty, due to the fact that necropsy findings may be negative, or they may be indistinguishable from the lesions of a number of other septicemic diseases. Therefore, in order to diagnose these diseases, one must evaluate all the information available concerning the premises, the drove, the symptoms exhibited individually and collectively, as well as such evidence as may be revealed by autopsy of two or more members of the herd. At times this is not readily accomplished.

Clinicians of long experience in this important field are often baffled, especially in borderline or complicated cases.

Hog Cholera

Definite diagnosis of hog cholera can be made only by inoculating filtered blood from one or more sick animals into healthy swine known to be susceptible to cholera. This is time-consuming and impractical in the field. The only advisable procedure in the field, therefore, is to study the history and the clinical and autopsy pictures carefully; then exercise the soundest judgment possible.

The history when available means much. Has the drove been properly immunized? At what age? What dosage was used? What care of both products and pigs was exercised. If convinced the drove has been properly immunized further and deeper search for the cause of the disturbance must be made. If the drove has not been cholera-immunized, the possibility that the ailment is hog cholera, must not be dismissed.

Next the onset of the disease in the drove is to be considered. How many animals sickened first? How long did they live after becoming sick? How long before others sickened? How many, if any, recovered?

Typical History.—The typical advent of hog cholera in a drove is: One or two animals become sick and linger around for a week or 10 days; then suddenly a number sicken. The owner did not think much about the first animal or two but when several sickened he became concerned. One often hears an owner say that he thought the first animal was injured in some manner, as sometimes happens, when the swine are running with other livestock. Such history is very valuable, when it can be obtained. An entire drove could sicken at the same time with hog cholera if all animals in the drove were exposed at the same time, but this is most unusual. Such cases have been encountered, however.

Next, the owner should be questioned concerning hog cholera or other swine sickness in the neighborhood. Such information, likewise, is helpful but not always obtainable. Many farmers still feel it is disgraceful to have hog cholera in their droves and try to keep it secret.†

Symptoms of Hog Cholera.—Inappetence is an early symptom of hog cholera. The sick animals lie in the nest and are aroused with difficulty. When aroused they tend to walk off a short distance and lie down again. There is pronounced depression. Weakness and a staggering or swaying gait, chiefly in the hind quarters, are an early symptom. This is not diagnostic but it should arouse one's suspicions. There is frequently knuckling of the fetlocks. There may be conjunctivitis, gumming around the eyes and the eyelids glued shut. This occurs in other diseases but chiefly in hog cholera. Constipation is an early symptom. It is followed by a watery diarrhea in five or six days. Temperatures are said to follow a rainbow curve; gradually rising to 104 to 106°F., sometimes higher, and gradually falling to subnormal as prostration occurs in the last stages of the disease. For this reason the temperature readings of several members of the drove should be taken. Rapid loss of body weight occurs. In the later stages of hog cholera pneumonia is a frequent complication. Discolorations of the skin that do not blanch on pressure may be noted, but they are common in other diseases also.

As a rule swine do not die suddenly from hog cholera. The peracute type, described in the early days, is not seen now. Hog cholera

*Presented at the annual meeting of the Indiana State Veterinary Medical Association, Indianapolis, January 15-17, 1948.
**Field Representative, Corn State Serum Company.

†In our state [Iowa], we have overcome this feeling to some extent by encouraging the reporting of such outbreaks to our veterinary association and the dissemination of the information through the press by periodical publication of disease bulletins, giving the approximate location of outbreaks. Farmers appreciate these warnings and many, therefore, take measures to prevent the spread of these diseases to their respective droves.

runs a course of a week or 10 days and, with rare and unimportant exceptions, invariably terminates in death. The first animal to sicken in a drove may live for several weeks and even recover, but in the meantime almost the entire drove may have succumbed. In the other septicemic diseases of swine, sudden deaths are not uncommon and recoveries are frequent. Convulsions may occur, but may be seen also

In hog cholera the animals are weak and depressed; in erysipelas they are nervous and alert

in a number of other diseases; even in dietary deficiency. Vomiting is frequent and so is lameness.

Necropsy Lesions.—There are no "typical" lesions of hog cholera. It is a septicemia, as are many other swine diseases. Petechial and ecchymotic hemorrhages on the epiglottis, lungs, heart, and kidneys; in the urinary bladder, gall bladder, stomach, and intestines are common to the whole group of septicemic diseases. The facts are that all organs and membranes may exhibit such hemorrhages. Some investigators maintain that the hemorrhages of hog cholera are more inclined to be round and are found more in the cortical portion of the kidneys than the hemorrhages in other swine septicemias. It is a good subject for discussion before the fireplace on a snowy afternoon, but it were a rash veterinarian indeed who would bet the value of his client's drove on it.

The lymph nodes may be hyperemic or injected with petechial hemorrhages. Some have claimed peripheral hyperemia to be diagnostic of hog cholera. It is not true. The spleen may be only slightly affected, showing mulberry-like infarcts under the capsule. The stomach is usually empty, since inappetence is an early symptom of the disease. Various stages of pneumonia and also a diffuse inflammation of the gastric and intestinal mucosa are usual in protracted cases. In the acute stages there may be complete absence of all such lesions.

One must, therefore, consider the history and clinical picture with great care along with the autopsy findings. The absence of evidence of other diseases is, of course, given weighty consideration. If there should be no septicemic lesions noted on autopsy a history and clinical picture indicative of hog cholera justify a tentative diagnosis of this disease even in the absence of lesions of septicemia. In a few days the autopsy picture would probably change, but by that time it would be too late to save the greater portion of the drove.

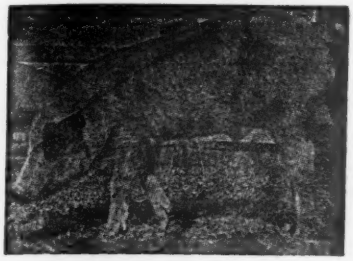
Other methods for the diagnosis of hog cholera are urgently needed and probably they will be devised. Leucopenia occurs in hog cholera, but the white blood count is not always dependable in the field because there are many factors that influence it. It is well, however, to consider it along with all other information available. My expêrience with the examination of the bladder for inclusion bodies is very limited, but with suitable equipment, it could no doubt be very helpful. All agree that improvement in the diagnosis of this disease is needed.

Swine Erysipelas

Swine erysipelas is a septicemic disease that, at times, is very difficult to diagnose in the field with any degree of certainty, because it presents such a variable picture. Sometimes it is very acute and at other times mild and sometimes only a few pigs apparently sicken in a drove and at other times it may run through the entire drove. There may be no death loss and again, in a very acute form, 50% or more may succumb. Sudden deaths are frequently encountered; in fact, a sudden death may sound the first alarm. As a rule, a number of animals show up sick at first; not just one or two, as in hog cholera.

Symptoms.—Temperature readings are extremely high at the onset, 107 and 108°F. being not at all uncommon. Stiffness and soreness are usually the first symptoms noted. Animals lie in the nest and are aroused with difficulty. When they try to arise, they evidence great pain and sometimes have to be helped to their feet because of the soreness and stiffness. After they move about for a time, this stiffness diminishes appreciably. The affected animal is alert, not depressed as in hog cholera. In fact, great nervousness is often exhibited. There may be severe conjunctivitis, but the eyes are bright, sometimes brighter than normal. Gumming of the eyelids is not noted. Constipation, diarrhea or coughing are seen as a result of complications. Scarlet congested areas in the skin which blanch on pressure may be found. This redness may be diffuse or at times circumscribed, assuming a diamond-

shape, hence the name, "diamond skin disease." The latter is considered a chronic form of erysipelas. Enlarged joints and stocking of the legs are commonly seen. At times there is swelling of the ears and in the region of the



The first indication of the acute form of erysipelas may be one or more hogs found dead. Others sicken rapidly. The temperature, in the beginning 107 or 108°F., usually drops to 104 or 105°F. within 24 to 48 hours

In the chronic form of erysipelas the infection may have lingered in the herd for months—even a year or two before deaths have occurred. Animals may be kept in the herd while suffering from erysipelas all unknown to the owner

tail. Welts and urticarial rash may appear over the body. In chronic erysipelas sloughing of the ears and tail and patches of skin, usually over the shoulder, is a conspicuous lesion. None of these symptoms are constant and all vary in intensity.

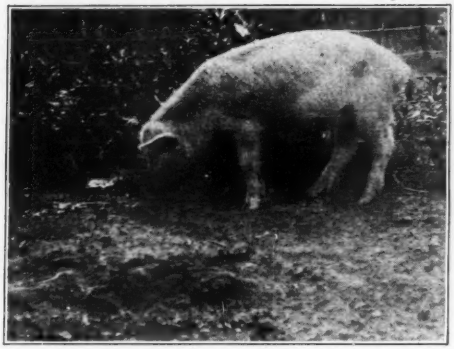
Autopsy.—There are no diagnostic autopsy lesions. The lesions are often those of a generalized septicemia, not discernibly different from those usually associated with hog cholera. Pulmonary edema is frequently associated with swine erysipelas. The lymph nodes are commonly enlarged, juicy and hyperemic, and may have a bloody appearance. The mucosa of the stomach, cecum and colon is sometimes bright red. The stomach usually contains some food and, in addition to being red, the mucosa is covered with a thick, glistening exudate. The "paint brush" hemorrhage on the serous surface of the stomach is not diagnostic. Vegetative endocarditis is occasionally found in chronic attacks of the disease, but this lesion is not as common in swine as it is in man. When present, however, this lesion is quite significant, although it may occasionally result from certain streptococcic infections. The enlarged joints contain an excessive amount of flaky synovia. In the acute stage the spleen is usually enlarged and bluish red in color.

The only definite method of diagnosis is by laboratory procedure. However, a laboratory examination that is negative does not establish the absence of swine erysipelas. Often the only location from which the *Erysipelothrix rhusiopathiae* can be isolated is an infected joint. It is, therefore, a good plan to include a swollen joint with any specimens submitted for laboratory examination. Simply saw off the leg above and below the joint, but do not incise the capsular ligament.

Response to the injection of swine erysipelas antiserum usually occurs within 24 to 36 hours. Many times great improvement is noted in this length of time. The serum is frequently used in this manner as a diagnostic aid. Sick animals so treated should be marked for identification.

Necrotic Enteritis

In my opinion, necrotic enteritis is just another type of *Salmonella choleraesuis* infection —a more chronic form than either of the two



Infectious necrotic enteritis

described in the foregoing. The symptoms, however, are still acute and animals still more active and alert. The appetite may be relatively good. A common expression is, "They eat their heads off." Diarrhea is profuse. There is constant loss of body weight; the affected animals becoming thinner and thinner. Some may show improvemet. The course of the disease may endure for several weeks. Of course, during all this time the bacteriological picture may become very complex. This disease usu-

ally affects swine from weaning to 125 pounds weight.

The lesions are found chiefly in the cecum and colon, which are extensively thickened and contain great quantities of necrotic or caseated material. A gastritis is often noted. The lungs may show a chronic bilateral pneumonia. A few septicemia lesions may be noted at times.

Acute Septicemic Suipestifer Infection (Salmonella Infection)

This is a very acute disease caused by the *Salmonella choleraesuis* (suipestifer). It develops suddenly in a herd of swine and a number of animals sicken at the onset. Sudden deaths are common. The disease usually occurs on farms where there is a history of old yard infections.

Symptoms.—Some animals continue to eat after becoming sick, but the appetite may be diminished. There is more alertness and less depression than in hog cholera. Sick animals are more easily aroused and roam about when they get up. In hog cholera they walk a short distance and lie down. The eyes are usually clear and not gummed. There is weakness but less staggering and knuckling than in hog cholera. Usually there is little or no coughing and the bowel passages are passably normal at the onset. The temperature readings vary from 104 to 108°F. Weanlings and shotes up to 125 pounds weight are the usual sufferers but the disease may, on occasion, affect swine of any age.

Necropsy.—A post-mortem examination reveals extensive septicemic lesions, that is, profuse hemorrhages on all organs and membranes. This profusion of petechiae and other hemorrhages is helpful in distinguishing this disease from hog cholera in cholera-immunized droves. In cholera-susceptible droves it is practically impossible to eliminate hog cholera from consideration. There is usually an extensive gastritis, the gastric mucosa exhibiting a beefsteak appearance, and with various stages of ulceration at times. The mucosa of the cecum and colon, likewise, shows extensive inflammation, edema and ulceration. The spleen is, in most cases, enlarged, pulpy, and of a purplish hue. This type of spleen is highly characteristic. For this reason a number of animals should be autopsied, not just one animal; in fact, autopsies should never be limited to just one animal in a drove, because of the normal variation of lesions in different animals. In this particular disease, it is a good plan to autopsy several subjects that have died, as well as those sacrificed for the purpose. Animals that have lived until they died of the disease may have had time to develop some diphtheritic membranes, which are indicative of a Salmonella infection of considerable duration. Diarrhea and other symptoms of infectious enteritis, are prone to develop in these droves.

Swine Dysentery (Infectious Hemorrhagic Enteritis)

Swine dysentery is an acute infectious disease of swine, characterized by bloody diarrhea which contains gross, red blood, mucus and sometimes particles of croupous exudate. At times quantities of practically free blood are passed. The same organisms are isolated from cases of this disease as from infectious gastroenteritis, according to some investigators, but they are unable to reproduce the bloody type of enteritis with the organisms isolated.

The onset is very rapid. Diarrhea is an early symptom. Bowel passages are usually very dark at first and in a day or two blood is noted. Affected animals may continue to eat for several days or longer. Dehydration and loss of body weight are extensive and rapid. Swine of any size or age may become affected, but younger pigs seem to be more susceptible than older animals. Temperature readings vary from normal to 107°F.

On autopsy, the lesions are confined chiefly to the stomach, cecum and colon. The stomach contains food. The cecum and colon contain great quantities of mucus and chocolate-colored fecal material or even free blood. If the animals do not succumb early in the disease, the picture will change by diphtheritic membrane formation. Secondary pulmonary complications sometimes develop. Septicemia lesions may be encountered and if the drove is cholera-susceptible, one cannot eliminate hog cholera from the diagnosis. This is the only difficult feature about the diagnosis of swine dysentery.

Infectious Enteritis or Infectious Gastroenteritis

Infectious enteritis is simply a less acute type of the same disease just described. It is caused primarily by the *Salmonella choleraesuis*. The first symptoms noted are diarrhea, with mucus and shreds of mucous membrane in the feces. Temperatures may vary from normal to 108°F. There may be sudden deaths. The eyes are bright; not gummed. The affected animals are alert and most of them jump up quickly when aroused. The appetite may be normal, diminished or totally absent, but they usually continue to eat at least a little. There is rapid loss of body weight from dehydration, especially where there is a profuse diarrhea. Infectious enteritis may affect swine of any age.

Post-mortem examination may reveal generalized septicemic lesions or the lesions may be confined to the gastrointestinal tract. The stomach may be full or partially filled with food. There is usually a gastritis, which may vary from pink to a beefsteak red. The mucosa of the cecum and colon show extensive inflammation and thickening, with diphtheritic

A section of small intestine from an affected sow, stretched and pinned to show the thickened and folded mucous membrane. X 1.4. Such lesions are uncommon

membrane formation and sometimes ulceration. The small intestine is affected only in rare instances. In animals having generalized septicemic lesions, the spleen is often enlarged, pulpy and purplish.

Swine Influenza

Swine influenza appears suddenly in a drove, with the entire drove becoming sick at almost the same time. It is attended with high temperatures and violent coughing. The animals lie in the nest, exhibit extreme weakness and rapid loss of weight. There is total loss of appetite, but sick animals continue to drink water and sometimes a little thin slop. The disease occurs in the fall and winter months and an attack lasts five or six days. If pulmonary complications do not develop, recovery is very rapid. Autopsy reveals highly congested lungs of a plum-red color, interstitial pneumonia, enlarged and congested lymph nodes and sometimes a few petechial hemorrhages are noted on the lungs. The air passages are usually filled with mucus, tinged with blood.

The diagnosis is not difficult, but the danger of hog cholera as a complication in unvaccinated herds is serious and a source of much anxiety to the diagnostician. It is a common occurrence to see a drove come down with influenza; then develop hog cholera and the whole drove perish. The mortality in swine influenza is light, except where pneumonia or hog cholera complications develop. Loss of body weight is the greatest economic loss from uncomplicated swine influenza.

Infectious Pneumonia

Pneumonia in swine is encountered as a complication of various diseases. It exists also as a distinct entity. Some old yards and buildings are contaminated with a type of infection which produces a destructive type of pneumonia, in which there is usually a greyish consolidation in the lungs with much fluid, foam and pus in the bronchioles. The anterior lobes of the lungs are affected first and as the disease progresses it extends to the diaphragmatic lobes. Edema is sometimes noted in the areas not solidified. Overcrowding, faulty housing, and dust are important contributing factors. Frequently pneumonia and enteritis are encountered in the same herd at the same time. On some farms we see enteritis one year and pneumonia the next.

Pasteurellosis—Swine Plague

Swine plague, caused by *Pasteurella suisepticus,* is primarily a pulmonary disease and manifests itself by reddish consolidated areas interspersed throughout the lungs with interstitial inflammation. Extensive septicemia lesions are noted.

In all pulmonary swine diseases, septicemia lesions may be encountered and at times they are very extensive. Consequently, in cholera-susceptible swine hog cholera cannot be entirely disregarded.

We also encounter pneumonias caused by different types of streptococci. Also a pulmonary edema, which may be complicated with Pasteurella, Salmonella, and diphtheroid organisms, is seen frequently. This information derives from laboratory reports upon specimens collected in the field. Without laboratory examination it is not possible to differentiate these infections. Some cases rapidly terminate in death, due to the edema of the lungs; ofttimes within 12 to 24 hours.

Symptoms of pneumonia are pretty much the same, whatsoever the cause. Labored breathing, thumping, nasal discharge, lachrymation and an elevated temperature, ranging from 104 to 107°F. There may or may not be much coughing. Also, there may be inappetence or diminished appetite.

This offers a very difficult situation to diagnose, at times. Only by experience and laboratory assistance can we learn to untangle all this confusion. Here again the history of

the drove and of the premises helps us, as well as the elimination of other diseases.

Swine Pox

Swine pox is frequently encountered in our section of the country. As a general rule it is mild; the animals not being noticeably sick, and death losses are slight. It is characterized by inappetence, high temperature and eruptions in the form of pustules on the skin, which rupture and scab over. Often the disease is so mild that it is not detected until the animals are restrained for the serum-virus treatment, when the eruptions are noted on the abdomen. These mild cases apparently do not interfere to a great extent with the serum-virus treatment, but it would seem that an added risk is entailed in immunizing even mildly affected droves. Pox varies in virulence to a great extent and consequently in the intensity of the symptoms. In highly virulent cases the mortality may run as high as 50%. Also, in such cases eruptions may be found all over the body. In acute cases it has been my experience to find septicemic lesions on autopsy not distinguishable from those usually associated with hog cholera. The virus is transmitted from animal to animal by the louse. Small pigs or shotes are usually affected, but mature sows have been noted to contract the disease. The course of the disease is about 10 to 14 days in individuals and four to six weeks or longer in a large drove.

Streptococcic Conditions in Swine

Streptococcic infections of various types are occasionally encountered in swine. They cause considerable concern at times in establishing a diagnosis because they often produce extensive septicemic lesions.

According to Ray[1] streptococci are believed to be the causative organisms in a number of infections in swine: encephalitis; some respiratory infections; infections of the inner ear; wounds of the feet and of the skin about the face, ears and jowl may become infected with streptococci and the infection generalized; tonsil infections; pyemic arthritis (navel ill); mastitis, metritis, and others.

My discussion will be limited to a few unusual conditions which may or may not be included in the foregoing list. The first is a disease, septicemic in nature, which is believed by many to be of streptococcic origin. Others consider it an allergy. Streptococci have been isolated quite regularly from tissue specimens submitted for laboratory examination.

In this disease there is inappetence, elevated temperature, 104 to 107°F., loss of weight, alertness, clear eyes, active when aroused, no staggering, no coughing as a rule and no diarrhea. Often blood is passed in the urine.

On autopsy a very profuse generalized septicemia is noted. Lymph glands are enlarged and dark. Hemorrhages, large and small, are found everywhere, even in the cutaneous and muscular tissues. Sometimes ulcerated tonsils will be noted. The most characteristic lesion, when encountered, is in the kidney; the entire hilus being a mass of blood and having the appearance of being burned black in places. This may extend down the ureters and into the urinary bladder. At times the urinary bladder is a mass of these blood blister-like lesions. The same lesions have been found in the gall bladder. The blood is often very thin.

Porcine bacterins, containing the causative organisms, are effective in controlling the disease. Sulfanilamide is also indicated and good results have been reported from its use. If the drove has not been cholera-immunized, a double dose of hog cholera antiserum and a regular dose of hog cholera virus should be given at the time the bacterin is given. The disease does not appear to spread from farm to farm.

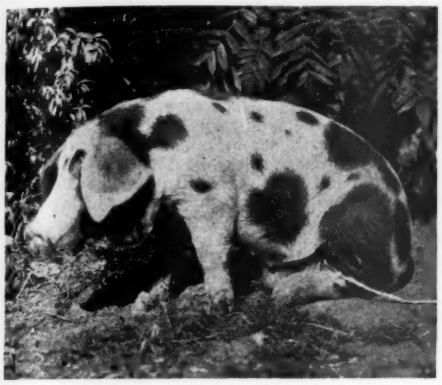
Case report: This drove consisted of nine sows, long-time cholera-immunized, and 85 pigs about three weeks of age. The sows suddenly lost their appetites and the pigs began to scour. The veterinarian noted the following symptoms: Temperature of the sows 102.5, 106, 107, and 107.5°F. One sow was bleeding from the nose. Another exhibited rapid and labored breathing. All the sows were wobbly on their feet and assumed attitudes suggestive of hog cholera. The sow with temperature of 102.5°F. was paralyzed behind. A consultant was called the next day. One sow was dead by that time and another was sacrificed for examination. Both were autopsied. Extensive septicemic lesions were found. All lymph glands were greatly enlarged, juicy and hyperemic. Extensive petechial and large ecchymotic hemorrhages were found all over the mucous and serous surfaces, on the glottis, heart, stomach, intestines, kidneys, urinary bladder, gall bladder, on the lungs, in various muscles, and in the skin. The hemorrhages appeared too extensive for hog cholera. The spleen of each sow had many mulberry-like infarcts. The hilus of the kidneys and the ureters were filled with blood. The lungs were soggy and saturated with fluid and foam. The one killed for autopsy contained less fluid in the lungs than the other, but it appeared to have been filling rapidly. Two little pigs were sacrificed for autopsy and their lungs were in the same condition. One sow had a bad udder and both

1 Ray, J. D., "Enteritis and mixed infections in swine." Vet. Med. 40:2 (February), 1945.

sows had extensively infected tonsils. The abdominal cavity of each sow was filled with fluid. There was gelatinous material in some of the fat areas.

A diagnosis of streptococcic infection was made and confirmed by laboratory examination.

Treatment: Each of the remaining sows received an initial dose of 200 grains of sulfanilamide, followed by 40 grains three times daily for three days. Also 10cc mixed bacterin, porcine No. 1, was administered to each sow and 3cc to each pig. Five sows survived, although one sow was extremely sick for three days. Twenty-two pigs survived.



Streptococcic septicemia

Another condition encountered is similar to ascites and hydrothorax. The abdominal and pleural cavities contain a vast quantity of a straw-colored fluid and the animal is distended as though having just consumed a big fill of slop. Breathing is impaired and the animal dies of suffocation. Temperatures may be elevated to 105°F. The disease runs an extremely rapid and fatal course. A few petechial hemorrhages may be noted on the mucous and serous surfaces. The fat around the kidneys and along the abdominal wall assumes a clear, jelly-like consistency. This same gelatinous infiltration may at times be seen around the gall bladder and pancreas. Streptococci have been isolated from these cases. Bacterins containing these organisms have been used successfully in inhibiting the progress of this infection. A second dose of bacterin should be given about the fifth day. A liberal dose of Epsom salt is likewise indicated to eliminate the excess fluid.

A third ailment is a gastritis in which the stomach wall becomes thickened and edematous in areas. The wall of the stomach may be an inch or more thick. Upon incising the thickened area a gelatinous mass will be noted between the mucous and serous membranes. However, the mucosa may exhibit only slight inflammation. Streptococci have been isolated repeatedly from these cases. Temperature readings may vary from 102 to 106°F. Vomiting and inappetence may be noted. Pronounced nervous symptoms and even convulsions have been noted, followed in a few hours by prostration, coma and death. Progress of the disease in individuals and in the drove is very rapid. In many instances it would seem that the drove had been poisoned by some plant or chemical, until autopsies are performed and the foregoing lesions noted. This condition is at times found following the feeding of a carcass or where the water supply had become contaminated. At other times there is no apparent causative factor of this nature. Errors of this kind should be corrected and bacterins administered. The disease is usually controlled promptly. Sulfa drugs, such as sodium sulfathiazole, are also indicated, intraperitoneally or sulfanilamide may be given orally.

During the past summer 30 shotes, in a drove of one hundred fine shotes, died as a result of this infection. The drinking fountain had become badly contaminated. This was corrected, bacterins and sodium sulfathiazole administered, and losses stopped within 36 hours, but not before 30% of the drove had succumbed. Thus it can be seen that the course of the disease is extremely rapid.

A short time later a drove of pregnant sows was examined, in which three sows had died the preceeding night. On autopsy of the dead sows, this same gelatinous infiltration was noted in the thickened wall and in the uterus. Bacterins and sulfonamides were administered to the remaining sows without further mortality. The water supply was changed and the sows moved from the orchard to a different lot as precautionary measures. No laboratory examination was made.

A fourth type of streptococci infection begins as a tonsilitis. At times we encounter immense swelling in the region of the throat. Breathing is impaired and the animals die within a few hours. Temperature readings range from 104 to 106°F. These cases make one think of anthrax, especially following the feeding of a carcass. Precautions should be taken not to overlook anthrax. In this particular condition, however, autopsy usually reveals the tonsils to be infected. The swelling in the region of the throat and neck does not contain gas, but there is much fluid and hyperemia in the tissues. The glands in the region of the swelling are hyperemic. Streptococci have been isolated from these tissues.

Sick animals are immediately segregated when symptoms appear and the watering equipment cleaned and disinfected very thoroughly, as this infection apears to be very readily transmitted by means of the water supply. If more animals sicken, the above procedure is repeated. Bacterins are usually administered to the well animals of the drove, although losses in some instances have stopped by simply following the above precautionary measures.

Occasionally we see pigs with a watery diarrhea and on autopsy we find very little enteritis, but extensive involvement of the tonsilar tissues is evident. Occasionally we see a mild pneumonia with tonsilar involvement. In either instance the pneumonia or enteritis is not extensive, surely not severe enough to cause death, yet animals are dying. In my opinion, streptococci infection of the tonsils will at times produce clinical pictures of this kind. Sanitary measures, bacterins and sulfa medication are indicated in such droves. Milk from cows affected with mastitis could undoubtedly be a causative factor and cases have been noted where that seemed to be the source of the trouble.

Interstitial pneumonia with gelatinous infiltration is frequently encountered. Streptococci have been isolated from these lungs and at times pasteurella organisms as well. Sanitary measures, expectorants and bacterin repeated in five days for three doses have been quite successful in checking the losses. Sulfathiazole has also been used by some veterinarians with success.

Metritis is often noted in one or two sows in a drove. One herd is recalled in which every sow would develop a vaginal discharge within two days after farrowing and death would ensue soon thereafter. Autopsy revealed an extensive metritis with generalized septicemia. Each sow was given an ounce capsule of powdered sulfanilamide with an equine balling gun as soon as the discharge was noted, and a half ounce capsule per day for two days following. Nineteen sows were so treated without a fatality. It seemed unusual to have metritis develop in so many sows in a single drove.

Conclusion

It has been my attempt to discuss the diagnosis of the most important communicable diseases. It will have been noted that all these diseases produce septicemic lesions at times. Therefore, their symptoms closely resemble those of hog cholera, the greatest killer of them all. In swine diagnostic work, one must never overlook hog cholera in a cholera-susceptible drove. If the drove has been properly immunized, one should seek further and deeper for the cause of the trouble. Sound prophylactic immunization against hog cholera, therefore, has a threefold benefit. It prevents hog cholera in the drove immunized. Each immunized drove acts as a barrier to the spread of the disease. Lastly, hog cholera immunization diminishes the costly confusion in the diagnosis of subsequent ailments in the drove.

Discussion

President Clark: We have heard a very valuable paper. I never saw a bunch of practitioners who didn't have some questions. Do any of you have any questions to ask?

Member: I would like to ask the Doctor's experience with delayed virus vaccination.

Dr. Hofferd: It has been used somewhat in Iowa, and I think with quite a bit of success. It doesn't always prevent virus reactions in complicated cases, but it does cut down mortality a lot. I have been a little reluctant to advocate it promiscuously. There may be some pitfalls, but it has worked out pretty well.

Member: I would like a little more information about swine pox. I had a call one day this week to see a herd of hogs. It was a good sized herd and they were dying at the rate of one to three a day. I could find nothing particularly wrong about it except the swine pox. It was one of the worst cases I have ever seen. They were vaccinated by a tissue vaccine about ten days previously, but I don't know if they were dying any faster now than they were before they were vaccinated. Is there any remedy for swine pox?

Dr. Hofferd: There is no treatment for swine pox. It is transmitted from animal to animal by lice, and the first step is to eliminate the lice.

Member: These hogs were the lousiest hogs I ever saw.

Dr. Hofferd: Eliminate the lice and give the hogs good ordinary care, and that is just about the extent of the treatment. It has been my contention that it is inadvisable to use tar products on pigs with pox, to eliminate the lice. I think there is quite a lot of absorption through the pox lesions and sometimes I think toxicity results from coal tar products.

Member: What about lime-sulphur dip?

Dr. Hofferd: Lime sulphur will not kill lice. Sulphurized oil is all right. Clean out the bedding, burn it, and get fresh bedding.

Member: Wouldn't you think that dry dip would be sufficient?

Dr. Hofferd: I have seen lice walk right through dry dip without effect. It is used mostly in cold weather when animals are closely confined and when weather prohibits liquid products.

Member: The talk on the streptococcus was very interesting to me. I think I have seen such cases and have been unable to diagnose them. Your treatment seems to be effective after you get it in the hogs, but there seems to be a period of delay while you are getting to it. Would it be advisable to inject some of the sodium sulfathiazole intravenously? A mortality of 30 to 40% was mentioned even after treatment is started. By injecting the sulfa drug directly into the bloodstream, would it be possible to cut down the mortality?

Dr. Hofferd: There is no question but that it would, for it would raise the sulfa level in the bloodstream a lot quicker. We have used sulfonamide intraperitoneally, and that seemed to give quicker action.

SWINE PRACTICE PROBLEMS*

By R. M. HOFFERD, D.V.M.
Cedar Rapids, Iowa

THE sow and suckling pigs, at times, present some very troublesome problems to the practitioner, who is not infrequently called to see droves of little pigs, that show no symptoms of any particular disease. They are small, emaciated, and dropping off at a rapid rate. The owner expects something to be done to save these pigs. This is impossible since the trouble started months previously by improper feeding and management of the sows, before and during gestation. Those pigs were born to die.

We are told that 35% of all pigs farrowed die before reaching weaning age. Of course, some disease factors enter into this picture, but poor husbandry is accountable for most of this tremendous loss. Poor progeny is at the top of the offending causes of our tremendous baby pig losses. By that is meant small, weak pigs at birth. A noted swine husbandryman made the statement at a recent veterinary meeting that pigs weighing three pounds at birth had an 85% chance of reaching market age and pigs under three pounds a correspondingly less chance.

At Purdue University of 203 pigs farrowed from 17 sows:

12 weighing two pounds each at birth were born dead—6%;

58 weighing two pounds each at birth died soon after birth—29%;

133 weighing 2¾ pounds each at birth were weaned.

In an Illinois test one group of sows weaned 13% of their pigs—another group weaned 83% of their pigs. The only difference was in the rations the two groups received during gestation.

The heaviest pigs at birth will be the heaviest at weaning time and will go to market first.

Feeding and management during gestation should be directed at producing strong pigs at birth. Sows should be kept gaining, have ample exercise, but not allowed to become too fat, which may result in weak litters. The sow ration should be balanced in every respect; protein, carbohydrate, minerals and vitamins. Pregnant sows need 14 to 16% protein—suckling sows 16% protein. Alfalfa in some form should be in every swine ration, also animal protein, preferably tankage or meat scrap.

Krider writes:[2]

Sows and gilts in drylot have been fed rations that contained adequate amounts of proteins, carbohydrates, fats, calcium, phosphorus, salt, iodine, manganese, and vitamins A and D, as well as appreciable amounts of riboflavin, niacin and pantothenic acid. The ingredients in one of the basal rations were: yellow corn, 83%; soybean meal, 8%; tankage, 5%; fish meal, 2%; minerals, 1.5%; and fortified codliver oil, 0.5%. The nutritional inadequacy of such a ration for gestation and lactation of gilts continuously fed in drylot was proved by the fact that weaning weights of the pigs were subnormal and that only 13% and 7% (two tests) of the pigs lived to reach weaning age.

The addition of 10 to 12% of high quality alfalfa meal to the above ration during the gestation period increased the percentage of pigs weaned to 82% and 83%, even though the inadequate basal ration was fed during lactation. The alfalfa meal supplied essential B vitamins, which were necessary for survival of the pigs. These results emphasize the importance of proper feeding during gestation if successful lactation is to follow. The nutrition of the sow must not be ignored when considering the problem of baby pig mortality. For each litter conceived, an average of only one service was required when alfalfa meal was fed in the ration, while an average of two services was required per litter farrowed by gilts in the basal group. Breeding efficiency was improved by the addition of alfalfa meal to the basal diet.

The selection of gilts for brood sows is important in producing bigger and faster gaining pigs and litters. At Ames a "Sow Testing Program" has been inaugurated, which goes something like this:

Sow testing is a program of keeping records on litter numbers and litter weights so the producer will have a better system of selecting sows and gilts for breeding purposes.

Here is the way it works out for the average farmer. All pigs are marked at farrowing time so that litter mates can be recognized. These pigs are entered in the record book.

At the age of 56 days, which is the normal weaning period, the pigs are weighed, the weights recorded and the litter weights figured for each litter.

When it comes time to pick gilts in the fall, the farmer can look at the records and select those gilts which came from large litters, weighing the most at weaning time.

Numerous experimental trials have proved that the heavier hogs at weaning time reach market weight at an earlier age. The weaning weight of a litter also is a good indication of the dam's ability to produce a liberal supply of milk.

Catron emphasizes that sow testing takes much of the guesswork out of breeding stock selection. In the past, dependence too often has been placed on general appearance alone.

You will say, perhaps, this is not the problem of the veterinarian. We cannot treat those little weak pigs successfully and we should not assume that responsibility. However, we can and should enter into an educational program

*Presented at the 64th annual meeting of the Indiana State Veterinary Medical Association, Indianapolis, January 15-17, 1948.

2 N. A. Vet., Sept. 1947.

along this line and disseminate this information to our clients. We shall likewise benefit.

Agalactia

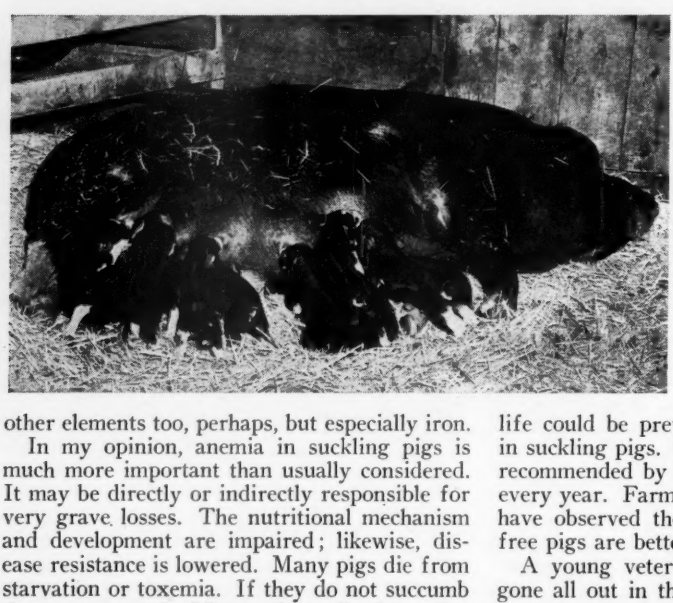
Some sows fail to produce milk and the little pigs starve by the time the sows come to their milk. The sow testing program and proper diet to the sows during gestation will, to a large extent, prevent this trouble.

Soaked barley was recommended as a very good milk producing feed by the late Doctor Kinsley, but it is too slow to save pigs in most instances, when the trouble is at hand.

Many practitioners use lentin or posterior pituitary extract as a mechanical stimulation to milk flow. Then if these fail, they resort to anterior pituitary extract to stimulate the milk secreting center. At a recent veterinary gathering Dr. J. C. Carey, West Liberty, Iowa, recommended the use of 5cc posterior pituitary extract and 10cc anterior pituitary extract simultaneously. He claims very good results from this method.

Anemia in Suckling Pigs

No matter how well sows are fed, iron is not transmitted through the mother's milk and little pigs must have iron to prevent anemia—



Most of the losses of young pigs are due to improper nutrition of the sow during gestation and lactation, but anemia can be prevented only by supplying iron in some form directly to the pigs.

other elements too, perhaps, but especially iron.

In my opinion, anemia in suckling pigs is much more important than usually considered. It may be directly or indirectly responsible for very grave losses. The nutritional mechanism and development are impaired; likewise, disease resistance is lowered. Many pigs die from starvation or toxemia. If they do not succumb they are stunted. Many others die from diseases induced by anemia, such as pulmonary or enteric infections or parasitic diseases.

In the routine autopsy of pigs, we note many in which there is an adhesion of the pericardial sac to the heart. This in most instances is a complication of anemia.

Placing clean sod in the farrowing house for little pigs to consume is a common practice, but this does not always suffice, especially if the sod does not contain the proper elements. Sprinkling the sod with a solution of iron, copper and cobalt is recommended by some. Or better still, treat each pig individually at a few days of age with a solution containing these elements. This can be done conveniently with an oil can. Treatment should be repeated every few days. Anemia tablets are on the market and very good results can be obtained by giving each pig a tablet at a few days of age. One tablet is usually sufficient, but this treatment may be repeated in a week or two if desired. If pigs are suffering from anemia, repeated individual treatments are essential. Do not be surprised if a few pigs die from handling. Every practitioner should use a Tallqvist scale routinely in investigating baby pig losses. He may be surprised at the incidence of anemia and sometimes where it is least suspected, in pigs already out on pasture. Pigs will often respond more readily to treatment for other ailments when the anemia treatment is added to it, if this condition is also manifest.

Surely many problems and losses in later life could be prevented by preventing anemia in suckling pigs. Routine anemia prevention is recommended by more and more practitioners every year. Farmers are keen for it when they have observed the results. Likewise, anemia-free pigs are better vaccination risks.

A young veterinarian in eastern Iowa has gone all out in the prevention of anemia, and he recommends these anemia tablets, to be given to the pigs individually.

In a short time in his office one day I saw eight farmers came in there after those "black anemia pills" they call them. They were talking amongst themselves and I heard some marvelous stories about the effects of thees pills.

This young doctor told me when we were

riding out in the country one day, "There is the farm where I had a chance to demonstrate the wonderful effects of these anemia tablets. We treated half of a drove of pigs and identified them by a marking. All during last season I observed this drove of pigs. We would see a pig that was much larger than most of the others and catch it and check on the mark, and sure enough, that pig would be marked." He said every pig that was above average size had a marking and had received one of those tablets.

This veterinarian told me not so long ago he had dispensed about 25 of those tablets to one of his clients, who was reluctant to buy enough tablets for his whole drove. The doctor said, "I will give you 25 tablets if you will use them on three pigs in a litter and mark them, but don't treat the whole litter." He said that fellow was in to see him a short time later and he was very angry. He said the only pigs that lived were the three that got those tablets. He said, "You knew all the time that was going to happen," and he was about ready to shoot him.

The doctor said, "You were so tight you wouldn't buy enough pills for your entire drove of pigs and I gave you those. You have no kick coming. You wouldn't have any pigs if I hadn't given you those tablets."

Mollified, the farmer said: "Really what I came for was some more tablets." He had a few more sows about to farrow. "I want some pills on hand to give the pigs when they come."

This veterinarian, in my opinion, is rendering his community a wonderful service by controlling anemia, as he does.

Brucellosis

This disease is mentioned here chiefly as a cause of baby pig mortality. The disease has many perplexities. Sows may abort once and carry succeeding litters successfully. Also sows may react to the agglutination test and later be negative or they may fail to react on a number of tests and later react positively.

Do not overlook the boar as a possible source of infection. A newly purchased boar will often create havoc in a herd. Many such instances have been observed. A number of successive negative tests are necessary to declare a boar free from the disease and safe to add to a clean drove.

It is realized that vaccination of gilts has not been generally recommended, but a number of good swine practitioners claim very good results by the use of Strain 19, 6cc administered to gilts from four to five months of age. On a number of farms unvaccinated gilts were retained as checks. These gilts aborted while the vaccinated sows produced healthy litters. The use of vaccine in purebred gilts sold subject to test, is objectionable.

Pig Scours

My experience has been that fully 90% of baby pig scours is due to faulty care and feeding of the sows. Cold, damp houses are conducive to pig scours. Also overfeeding or improper feeding of the sows. The housing should be corrected. Reduce the feed of the sows or correct the ration if it be too concentrated. Then give the sows a saline purgative to eliminate the toxic products in the digestive tract. In most instances the scours in the little pigs will cease without medication.

Numerous remedial agents are given to the sow. Perhaps the one most commonly employed is formaldehyde, but many prefer methenamine, which is eliminated as formalin in the milk of the sow.

There is a type of infectious scours and enteritis in suckling pigs which is difficult to handle. Proper diet, sanitation, bacterins and formaldehyde or methenamine are all recommended. Sometimes weaning the pigs at a very young age is necessary. There is also the gastroenteritis, of very young pigs, described by Doyle and coworkers. Death losses are rapid and extensive. No treatment of value is known.

Sows as Disease Carriers

We hear much about sanitation in swine production and justly so. On many farms profitable swine production became impossible due to environmental infections. The McLean County system is the answer. But occasionally this method fails.

It has been observed that among sows scrubbed and moved to a meadow to farrow in clean houses, certain litters of pigs developed enteritis when the pigs were but a few weeks old. In other instances the pigs did well until after weaning and then developed enteritis. If the disease develops when the pigs are a few weeks old, these sows and litters should be removed immediately to prevent spread to the other litters.

Such enteric infections are probably carried in chronic lesions in the sows or perhaps in the gall bladder as demonstrated by Smith.

Pulmonary infections may also be transmitted from sows to pigs. The infections in this instance is probably harbored in old lung lesions. In any event, it happens.

These diseases are exceedingly difficult to treat in young pigs before they take nourishment other than their mother's milk. Often it is necessary to wean the pigs at a very young age in order to reduce the intake of the infection. Such pigs have a very difficult time, but by weaning and moving many survive that otherwise would die.

Selection of gilts is important. This should be made from droves raised according to the McLean County system and known to be free from disease. On farms where these diseases have occurred, farmers should be advised not to retain gilts for breeding purposes.

Quite some years ago when I was with the Bureau, I was called up to Waterloo in consultation by Doctor Moeller to see a drove of swine infected with enteritis. Moving these pigs out to clean grounds was advised on the theory that by reducing the intake of infection treatment would be more successful. That was done and the pigs got along really well. Some months later I was called back to see another drove, and advised the same thing. We told this farmer, "Now, when you select gilts for brood sows, purchase some from a man who is raising them out on clean ground."

The farmer thought that was a good plan and drove down the road looking for hogs out in the field. He saw this herd we had been to see previously and had moved them out on clean ground and said to himself, "There is a fellow who has got his hogs out on clean ground. I will see if I can buy some gilts from him." He bought them, and lo and behold, in the spring when they farrowed, the pigs developed enteritis just as bad as he had ever had. Undoubtedly, those gilts that we had moved out on clean ground were carriers of enteritis infection. Perhaps most practitioners can remember a great many cases where that has happened.

I remember a purebred Berkshire breeder at Fairfield, Iowa, having a lot of trouble with pneumonia in pigs. Many of his pigs died and those that lived were no good. As a consequence he had no purebred gilts or boars for sale. It was quite a problem. His veterinarian called me in consultation to look the situation over. The breeder wanted to retain some of his blood lines. He had a lot of land available and movable houses, but they had never accomplished anything for him. Most of his breeding stock was infected and the pigs acquired infections soon after they were born or when they got to associating with other litters. We recommended building a little pen around each one of those movable houses and retain the sow and litter in this pen. We told this breeder that when these sows farrowed, little fellows in some of the litters will start to thump and show evidence of this pulmonary infection, but some litters will probably be all right. "Don't let those sows with infected litters or any of the pigs in those litters get with any of the other litters. Sell those sows and all of their litters that survive when they are big enough, and retain your breeding stock from the litters that have not shown any infection."

He cleaned up that lung infection by that method. He got rid of the sows that were carriers of the infection and picked these gilts out of the litters that had shown no infection, and gradually developed a clean strain of stock.

Control of Enteritis of All Types

1. Sanitation is all-important. We must reduce and control the intake of infection no matter what treatment is employed. Segregation of sick animals is the first step.

2. Many prefer treatment in a drylot or on a feeding floor. This may be successfully accomplished, but sanitation is more difficult to maintain than on pasture. On a feeding floor, the floor must be cleaned and scrubbed or hosed several times daily.

3. My preference is to move the good portion of the drove to an alfalfa or clover field. The sick portion should also be moved in like manner but kept separate from the healthy portion. Success has attended this plan, after all treatment, without movement to clean ground, failed.

4. Shotes may be moved to a cornfield in late summer or early fall.

5. Diet is important. (a) Corn should be withheld. (b) Whole oats is generally used but does not supply sufficient nourishment and should be supplemented with middlings, shorts, red dog flour, buttermilk or milk, alfalfa meal, or a little ground wheat. (c) Tankage or meat scrap may be added to the ration. Cases have been noted in which this was very helpful.

I recall an incident during the war when I went with a veterinarian to see a drove of pigs that he was treating for enteritis. He said that he moved them to clean ground in individual houses and segregated the sick pigs. He had used just about everything in the treatment of these pigs; all with no benefit.

We autopsied a couple of the pigs. They had enteritis for sure. I recalled hearing a veterinarian tell of treating some pigs for enteritis that broke out of their pen into the feed room, where they consumed all the tankage they wanted. Although he expected it would probably kill those pigs, it astonished him for it apparently cured them!

Since everything that anyone knew had been done for these pigs and they were no good as they were, it seemed a good place to try heavy tankage feeding. It was during the war and tankage was scarce and hard to get, but this man had some on hand. It was recommended that he accustom these pigs to it at once and as soon as possible supply it free choice. The sequel: it worked again.

I learned later that in about three days this drove of pigs had a different appearance, and in a week the diarrhea ceased and they started growing and made good hogs.

The veterinarian with whom I saw this drove has made it almost a routine since to put pigs suffering from enteritis on a heavy tankage ration. He states that it is very helpful.

Certain amino acids that are present in tankage but are not contained in any other proteins apparently are helpful in building disease resistance.

6. Repeated doses of porcine mixed bacterins are sometimes helpful, but not always.

7. Different types of medication are used and all are more or less successful if used in conjunction with sanitation and proper diet. Alkaline solution, salt treatment, sulfathiazole or sulfathiazole sodium, other sulfonamides and other salines may be used to replenish the cellular salts and control dehydration.

8. Nodular worm infestatoin has been of increasing importance in connection with the treatment of enteritis. It is practically impossible to clear up a drove of swine affected with enteritis if extensively infested with nodular worms. Treatment with phenothiazine has been quite successful in removing this parasite. It should be followed by the usual enteritis medication.

9. Whipworms are probably of importance, but unfortunately, there is no known vermifuge effective against these parasites.

10. In winter time a practical method of sanitation is to divide the hog house and feeding floor into two sections. Half of the hog house and half of the feeding floor are used one day, while the other half of each are cleaned and disinfected. The next day the hogs are moved to the cleaned half and the other half cleaned and disinfected. This process of alternation every day has been entirely successful in many instances.

Pneumonia

Pneumonia in swine is commonly encountered either as a primary factor or as a complication of a number of other diseases. Since septicemic lesions are frequently noted in pneumonia cases, a great deal of confusion often exists in the mind of the clinician. Hog cholera must always be considered as a possibility in cholera-susceptible droves. Pulmonary edema is likewise a frequent finding in swine erysipelas. Frequently we see pneumonia and enteritis in the same drove.

To save time some of the important features only will be considered.

1. Infectious pneumonia is very troublesome on many farms as is enteritis.

2. The McLean County system may be the answer on some farms. Sows may be carriers.

3. In treating sick droves moving is often very important.

4. The water supply may cause trouble. It should be kept clean and may be chlorinated as a further safeguard in controlling reinfection.

5. Dust is an important factor and should be eliminated as much as possible.

6. Repeated doses of pulmonary bacterins are at times helpful. Bacterins should be repeated in order to prevent recurrence. Three doses, five days apart, are preferred. Recurrence also has been noted following the use of sulfonamides. Bacterins are helpful in that they build up an immunity to the infection.

The sulfonamides cannot be given over a period long enough to establish full recoveries in these lungs. There are many instances of consolidated areas in the lungs and it takes about 14 days or so for these lungs to clean up. Sulfonamides given for five or six days don't always accomplish the desired results, since when it is withdrawn the pigs go right back to where they were. The lungs haven't healed. The same is true of one dose of bacterin or perhaps two doses. When a dose of bacterin is given the resistance of the animal is raised for approximately seven days. Then the effect tapers down and is lost before these lungs are completely healed. So by giving three doses five days apart the effect of this bacterin is long enough for recovery to take place in those lungs, and they stay all right. Sometimes two doses of bacterin seven days apart are adequate but my preference is three doses five days apart.

7. The addition of alfalfa in some form to the ration has been very helpful at times when all treatments failed without it. I have seen that happen on numerous occasions in treating a drove of swine for pneumonia. They would not respond to any treatment until 10 to 12% of alfalfa meal was added to the ration. A good recovery ensued. There is something in alfalfa that helps these pneumonia cases, and I strongly urge its use. In fact, I don't think any swine ration should be without alfalfa.

8. Good management is essential. Ample housing to prevent overcrowding. Warm, dry sleeping quarters, free from drafts in cold, inclement weather is essential. A straw loft is good equipment in an otherwise damp and drafty hog house

9. Various types of medication have been employed, including expectorants, sulfonamides and salines to replenish cellular salts lost in dehydration. These are beneficial if used in conjunction with the other control measures enumerated.

Septicemia Disease Problems

Probably the most confusing problems in swine practice arise as the result of septicemic diseases. Hog cholera is a disease of this class, but there are many others. Hog cholera is preventable but incurable. Therefore, it is essential that a diagnosis be made early, before this disease gets a good start in the drove. It is often difficult to determine what procedure to adopt at this early stage. If we wait until the disease is easily recognized, we shall then have passed the time when we can be of service.

We should first obtain all the information possible concerning the history, clinical and autopsy pictures. By careful evaluation of this information we can usually arrive at a decision. In my opinion, it is not possible to make a positive diagnosis of any septicemic disease of swine in the field. It takes careful study and the exercise of good judgment to arrive at a decision, and then many times we do not know what is best to do. We should bear in mind that hog cholera may at times exhibit no lesions and also we may have more than one disease at the same time. The safe thing to remember is, *Do not overlook hog cholera in a cholera-susceptible drove.*

A few years ago I was discussing swine diseases with a practitioner, who had been encountering a great deal of swine erysipelas. He thought he had become proficient in the diagnosis of this disease. Of the many cases he had treated all responded satisfactorily to the injection of antiserum. I cautioned him not to forget hog cholera, whereupon he became indignant; stating that he could diagnose erysipelas. The next time I saw him he apologized for rejecting my suggestion, stating that he had lost two entire droves in which he had made a diagnosis of swine erysipelas. They had died of hog cholera.

Numerous cases of this kind could be cited, often attended with tremendous losses. Do not hesitate to use hog cholera antiserum and hog cholera virus even though you suspect swine erysipelas if the herd has not been immunized against hog cholera. You may give swine erysipelas antiserum in conjunction with the cholera vaccination if you wish, and it would be good procedure, especially with the obviously sick animals. The point is, *do not let hog cholera catch you off your base.*

Another point to remember: do not be too positive in your prognosis in outbreaks of swine erysipelas. The antiserum *usually* works like a charm in the acute stage, but sometimes it does not. Be a bit guarded.

Salmonella suipestifer (*choleraesuis*) infection in joints, cannot be differentiated clinically from enlarged joints due to swine erysipelas. In these cases swine erysipelas antiserum does not work.

Dr. J. W. Giffee, U. S. Inspector on Hog Cholera Control, reported that many sows in eastern Iowa last spring, showing only a very high temperature and inappetence, responded uniformly well to swine erysipelas antiserum.

In eastern Iowa we had been accustomed to noting quite a bit of lameness and soreness in pigs at the onset of the swine erysipelas. We hadn't been getting this extremely acute form, that had been encountered in western Iowa and in Nebraska and South Dakota. In that form they didn't always get this marked stiffness and swelling of the legs. The point is, it is not always necessary to have a great deal of stiffness and swelling of the legs at the onset in swine erysipelas.

Salmonella cholerasuis infection seems to be one of our big headaches. It can assume septicemic proportions and, in fact, produce more profuse hemorrhagic lesions than hog cholera. Infected pigs are usually more active than in hog cholera. They are less depressed, the temperature readings are higher. But in a drove not cholera-immunized, do not overlook hog cholera. One cannot say hog cholera is absent just because Salmonella are present.

Salmonella cholerasuis causes the most serious upsets following the serum-virus treatment. It may be a causative factor in enteritis, pneumonia, arthritis, or acute septicemia.

Sanitation, bacterins (repeated doses) and enteritis treatment are all indicated. But what about the cholera-susceptible drove? Do we recommend serum alone or serum and virus? The virus might add fuel to the fire. Some prefer to give hog cholera antiserum alone and treat them again with serum and virus at a later date. Others give a double dose of serum and a dose of virus immediately. Still others give a liberal dose of serum immediately and virus seven or eight days later. Still others give bacterin and hog cholera antiserum and in seven days virus and bacterin. This is a problem that should be discussed fully with the owner and let him help decide, because heavy losses are apt to occur with any procedure adopted.

Many other problems could be discussed in this category of diseases. Swine pox assumes septicemic aspects at times and may cause extensive losses. Also a number of streptococcic infections may be encountered and these offer confusing problems.

In closing I may say, I have attempted to offer something practical and different from the usual swine paper, in which you have heard all the old diseases hashed and rehashed. It is hoped that my aim has been accomplished.

RABIES CONTROL*

By RAYMOND FAGAN, D.V.M.**
Indianapolis, Indiana

PERHAPS a consideration of the extent of the rabies problem here in Indiana should be taken up first. The incidence of rabies in this state from 1914 to 1947, is shown graphically in Chart I. It is obvious that, in the past 34 years, there have been three distinct cycles of rabies prevalence, with the highest peak in 1935; a slightly lower peak in 1927 and a third peak now in the making. If the cycle repeats itself, as it has in the past, Indiana is due for another great increase in the disease within the next two years. The fact that the number of cases has doubled since 1943 and increased 25% from 1946 to 1947 shows the present trend toward another peak.

The 1947 map shows where our efforts should be concentrated to smash the present epidemic of rabies before it gathers overwhelming strength.

The last chart is inserted to show the seasonal incidence of rabies. The bars represent the aggregate number of cases in each month of the year during the 34 year period under consideration. Thus the 156 cases shown for January is the sum of all the cases of the 34 Januaries during the period. The same applies to the other columns.

The peak in total heads sent to the health department for examination is reached in May and stays up in June and July. The total positives for rabies reaches a peak in May also. If there is such a thing as a rabies season in Indiana, it is in the late spring and early summer—not in the dog days of September as the fables have it. In any case the variation is only from a low of approximately 700 cases in November and January to a high of 1100 in May.

It is interesting to note that when the number of heads sent in goes up, the percentage of positives goes down.

State laws concerning rabies provide compensation for animals killed or maimed by rabid and vicious dogs, for official examination of heads in cases suspected of being rabies, and also payment for the Pasteur treatment of persons. It should interest practitioners to know that the township trustee can pay for the Pasteur treatment of any veterinarian who is bitten by a rabid dog.

Rabies is an acute infectious disease of the central nervous system. All warm-blooded animals are susceptible. It is caused by one of the larger viruses. Infected animals transmit the disease to susceptible animals and persons by contaminating a wound with saliva that contains active virus. Thus far, there are no cases on record of the disease being transmitted through the ingestion of the meat or milk of an infected animal. All experimental attempts to transmit the disease in this way have failed.

The virus must be deposited in nerve tissue and then it propagates itself centripetally until it reaches the central nervous system to which all symptoms are referable. All deaths from rabies result from paralysis. Whether this is

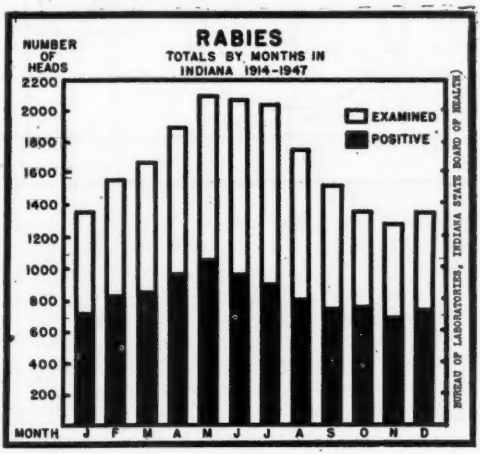


Chart No. I

the only phase the animal passes through or whether it goes through a furious phase of hyperirritability, depends on the amount of virus deposited in the nerve. The greater the amount of virus and the shorter the incubation period and the more likely that paralytic rabies will develop. The less the amount of virus, the longer the incubation period and the greater the possibility that the furious stage will be the predominant symptom. The longer the incubation period, the better chance Negri bodies have to develop; the shorter the incubation period, the less chance for their development. Consequently for the complete diagnosis of rabies, a mouse inoculation test is necessary in cases suspected of being rabies, but where no Negri bodies are found. If the virus is present in the brain, the test mice will die of rabies.

The virus can be recovered from the saliva of only about 50% of rabid animals. This

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**Veterinary Epidemiologist, Indiana State Board of Health.

partly accounts for the fact that not all susceptible animals bitten by rabid animals develop rabies. Secondly, animals, especially dogs, exhibit a considerable amount of natural resistance to rabies. Transmission experiments where dogs have been inoculated intramuscularly and subcutaneously with virulent virus have repeatedly demonstrated this fact.

With these points in mind, the genesis of an epidemic can be considered. The chain of events is simple. An infected animal bites a susceptible animal, which becomes infected and bites other susceptible animals and so the chain of extension continues. If there are few infected and few susceptibles then there is little likelihood of an epidemic. If there are few infected and many susceptibles an epidemic may result, but if there are many infected and many susceptibles an epidemic is in the making.

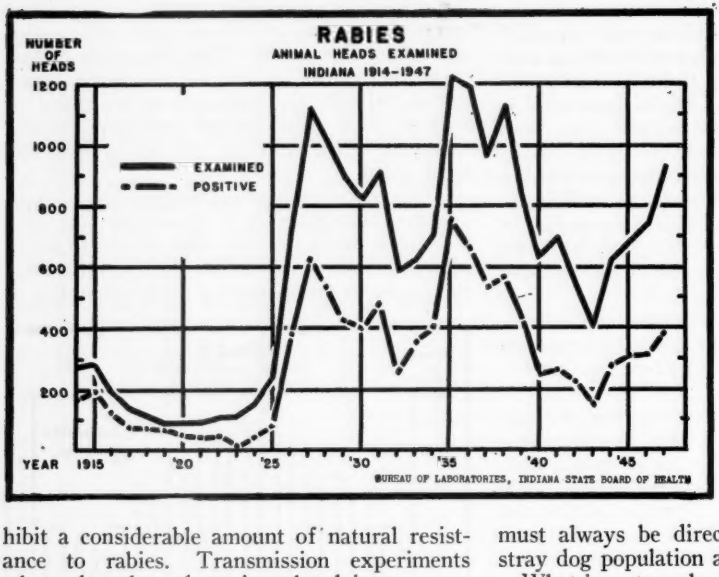
To control rabies: (1) decrease the number of susceptibles by (a) destroying the infected animals before they infect others or (b) cutting down the susceptibility by vaccination; (2) lessen the chances of contact between susceptible and infected animals by restricting the movement of all animals.

The foregoing is the broad general outline of rabies control.

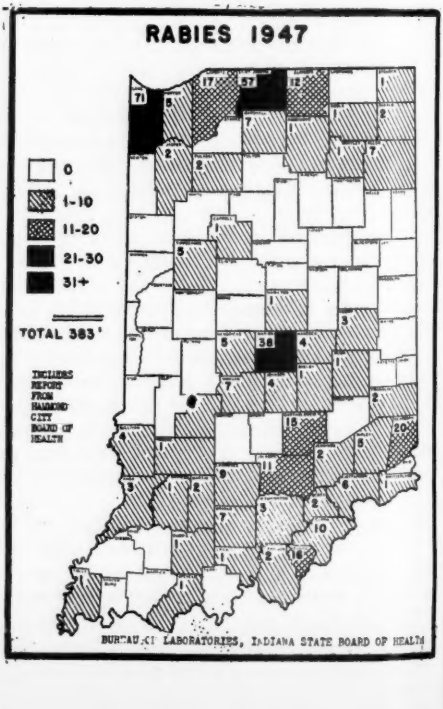
There is no doubt that, in the main, the dog is the most important animal in the spread of rabies. And of all the dogs in a community the strays are most responsible for the initiation and dissemination of rabies outbreaks. When the stray dog population becomes excessively large, the introduction of a single rabid animal is enough to set off an epidemic of rabies. Such an epidemic is not confined to the stray, homeless, unwanted dogs, but it will include all types of dogs in a community. Consequently, efforts must always be directed toward keeping the stray dog population at a minimum.

What is a stray dog? For practical purposes it is one not under the control of his master

Chart No. II



"It is interesting to note that when the number of heads sent in goes up, the percentage of positives goes down."



or his master's agent. This includes dogs whose owners allow them to run loose in a neighborhood anytime of day or night. In some cities, a stray is defined as any dog that is off leash.

What is the best procedure in handling the stray dog problem? The most sensible procedure would be to have a dog-catching force with proper equipment police the streets and pick up all stray dogs. Then the dogs should be brought to a dog pound and kept there for a few days to give owners a chance to claim them. If a dog is not claimed within a reasonable period, it should be disposed of.

Obviously such work requires the expenditure of public funds. There are many ways to raise funds. The most obvious is through the dog tax. When a man pays a tax on his dog, he has a right to expect the community to give him and his dog some protection. And the most obvious protection is keeping the dog population under control; for in this way the dogs in the area are known and any harm done can quickly be attributed to the offending animal.

The second way to raise money for dog control work is to fine an owner every time his dog is picked up by the dog-catcher. The fee should be large enough to discourage permitting dogs at large. There should also be a fee for the board and keep of the dog so long as it is impounded.

Before any dog is let out of custody, it should be vaccinated against rabies or satisfactory evidence of a recent vaccination should be required.

At this point it would be wise to discuss the place of vaccination in a rabies control program. Without much dissenting opinion, it is generally conceded that since the institution of the Habel test for potency, commercial vaccines are effective in increasing an animal's resistance to rabies. Therefore, vaccination is an excellent means of helping control rabies, because it cuts down the susceptibility of the animal population. Since it is not 100% effective, it is doubtful whether vaccination alone can eliminate rabies from an area. However, in conjunction with dog control and elimination of strays, vaccination will rapidly eliminate rabies.

Nothing has been said about the rabies in wildlife. Such sections of the country as New York State, Georgia, Mississippi, Alabama and others in the southeast part of the United States have a serious problem with rabies in the fox. The generally recognized procedure in dealing with this situation is to shoot and trap foxes. By so doing, the population is cut down, and rabies in that species is controlled. So long as the population is kept down by hunting and trapping, rabies from this source will not be a serious menace to man or his pastured cattle.

It is generally agreed that dogs should be taxed and that the funds so raised should be used for dog control and to pay for damages done to persons, animals and property. This taxation provides an adequate record of the dog population and enables one to say which dog and dog owner is responsible for any reprehensible act.

To enforce the taxation law and at the same time eliminate strays from the community, a novel suggestion has been offered, which should work out well. The police should be delegated to handle this problem in communities which do not have a dog-catcher.

It is common knowledge that in most communities where the police handle dog control such enforcement is lax. To stimulate the collection of strays one has to find some incentive for the law enforcement agents. To that end the following is proposed: All persons whose dogs are picked up and delivered to the community pound should pay a fine for the return of their pets. This money should go to the police pension fund. This will provide a superb incentive for the police to pick up strays.

In addition to paying a fine the dog owner should pay for the board of his dog at the pound. This will aid in dog pound maintenance. And finally, before the owner can get his dog, he should have his dog vaccinated or show proof that it had been adequately vaccinated within a reasonable period.

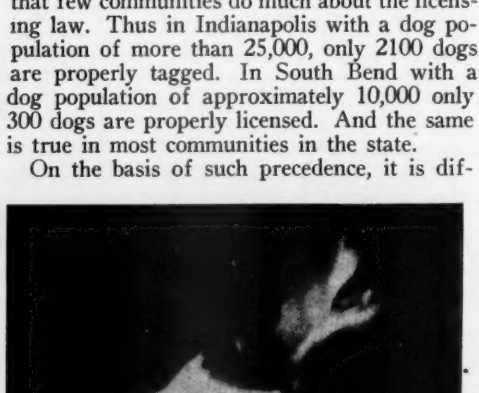
The second consideration is vaccination. Since it is agreed that the procedure is worthwhile, how shall it be integrated into the program of dog and rabies control? There are two ways of administering a vaccination program. One is to make the procedure compulsory and the second is to try to get the dog owners to have their animals vaccinated voluntarily. Let's consider each procedure and see how each works.

Compulsory vaccination is usually implemented in one of two ways. The most common method is to make the vaccination of a dog a prerequisite to getting a license. Such procedure is superb when the people are accustomed to license their animals. With a very small amount of persuasion they can be convinced of the value of vaccination. Such method has worked well in Phoenix, Arizona; Montgomery, Alabama; Columbus, Georgia; and Akron, Ohio. The second way is to pass a law making vaccination compulsory and not tying the immunization procedure to licensure.

The difficulties with such compulsory procedures are obvious and they all trace back to

the enforcement of compulsory dog control measures. In Indiana today, it is required that all dogs be licensed. However, it is well known that few communities do much about the licensing law. Thus in Indianapolis with a dog population of more than 25,000, only 2100 dogs are properly tagged. In South Bend with a dog population of approximately 10,000 only 300 dogs are properly licensed. And the same is true in most communities in the state.

On the basis of such precedence, it is difficult to believe that any law in Indiana involving compulsory dog vaccination would work better than the compulsory license law or the law to prevent dogs from running at large.



Stray dogs constitute a rabies infection pool

This leaves only one approach to dog vaccination—voluntary immunization of dogs. This procedure, as a community project, requires careful planning and detailed work. The whole community, not only the dog-owning population, must be informed by all educational means at the disposal of the health authorities on the nature of rabies, its cause, its effects and its prevention. They must be approached with the idea that the vaccination procedure is for the protection of their dogs and of themselves, and not just compliance with a law. A successful program of this type bears the best fruit.

In New York State such a program has worked extremely well in the upstate areas. The local health officer was aided and advised by a Rabies Advisory Committee which consisted of representatives from dog clubs, humane societies, law enforcement agencies, the public-at-large, the newspapers and the veterinary profession. With the solid backing of the advisory committees the program has worked successfully.

What is the role of the practicing veterinarian in any rabies control program? It is purely technical. He is the man who does the actual vaccination and who supplies the information regarding all phases of the disease in animals. He is the one who best knows the rabies situation in a community and who can keep his local health officer advised on the dog population and whether it is getting out of hand.

Whether the vaccination is done on a clinic basis or an individual basis, whether the dogs will receive the vaccine without cost to the owner or whether a fee will be charged are all questions for the Rabies Advisory Committee to decide. The veterinary profession must set up conditions under which it will participate in the program. Perhaps the best procedure would be a veterinary rabies inspector for each county who would be responsible for seeing that regulations for control and elimination of the disease are enforced.

It would be advantageous if the practicing veterinarian reported all cases of rabies that he diagnoses. Thus it would be possible for the animal disease control officials and the public health authorities to get a more accurate picture of conditions in the state; where control efforts should be concentrated and how great is the economic loss from rabies. The best source of information is the man who actually sees the cases and who diagnoses them, the practicing veterinarian.

Let us summarize what a good rabies control comprises:

1. Education of the community concerning the cause, effects and prevention of the disease.
2. An effective dog control program which would include (a) licensing dogs to secure funds for operation, (b) registering dogs to get an idea of dog population and ownership, (c) impounding stray dogs and destruction of unwanted ones.
3. Vaccination of all dogs over six months of age at least once a year with a vaccine of tested potency.

With a population cognizant of the problem and the methods for handling it, any community can work out a specific program which will fit its needs and solve the rabies problem. It has been done all over the world and in many communities in the United States. It can be done in Indiana.

The Distemper Complex in Small Animal Practice*

By J. H. KNAPP, D.V.M.
Columbus, Ohio

CERTAINLY this subject should stimulate a great deal of discussion. Some will disagree with what I am going to say. I hope they will make their disagreement audible. Today in small animal practice the problem of distinguishing between the disease of Carré and the so-called mixed bacterial infections is often encountered. How many feel that they can properly differentiate the disease of Carré from the mixed bacterial infections. Frankly, I know how many headaches these conditions can produce for the small animal practitioner.

The symptoms of canine distemper, which more recently is being referred to as the disease of Carré, are difficult to differentiate definitely from the condition due to the mixed bacterial infections, in dogs. The following symptoms are typical of the early stage of canine distemper: partial loss of appetite, slight dry cough, bronchial in origin, mild tonsilitis, vomiting, conjunctivitis and listlessness. Frequently an animal will not manifest sufficient symptoms of the virus infection to call it to the attention of the owner. Lacrimation and a mild inflammation of all visible mucous membranes may be all that is noted even by close observation. A temperature, which rises irregularly to 103.5°F., usually attends virus infection. If the temperature is 104°F. or higher, one should suspect either the secondary infections which follow the disease of Carré or that some other condition or disease exists. Cases of virus canine distemper, when presented within one to three days after the first noticeable symptoms, will respond well to the administration of homologous serum or to the administration of multiple doses of the Green distemperoid vaccine. When using serum as a treatment, a large dose should be given at the first and only injection. Dosage should be 1.5 to 2.5cc per pound, body weight, depending upon the physical condition of the animal and the stage of the disease. When animals are in poor physical condition, parasitized or suffering from malnutrition, give from 2cc to 3cc per pound, body weight. This procedure is augmented by the use of the sulfonamide indicated, depending upon the most prominent symptoms. If they be gastrointestinal, sulfamerazine or sulfaguanidine should be used while if the respiratory symptoms are most pronounced we prefer sulfamerazine, sulfadiazine or sulfapyridine, in the order named. The dose in any instance is 1.5 grains per pound, body weight, as the initial dose. It should be given four to six hours after the administration of serum (intraperitoneally) and the same amount should be repeated each 24 hours divided into four equal doses, for 48 hours. If the response isn't satisfactory at the end of the second 48 hours, then give gradually decreased doses. Then change the therapy to include the use of various bacterins, vaccines, toxoids, penicillin or streptomycin. The use of these will be discussed later. Generous advice to avoid drafts, maintain regular environmental temperature, etc., is given. A good ration is prescribed, one high in protein and including foods that are easily digested, palatable and not too bulky. Following active exposure to the virulent virus of Carré, an animal that has had no prophylactic treatment will show symptoms within four to seven days.

Where the owner is unwilling to pay the added cost for serum or in very large dogs where the cost of homologous serum would be excessive the use of multiple doses of the Green distemperoid vaccine is preferable. If this be used, the therapeutic dose is 2 to 3mg per pound body weight, given in a single dose. The results are often phenominally beneficial and supportive treatments are kept at a minimum. There should be an active response in from 48 to 72 hours. When the vaccine has been used we have observed less of the undesirable end results such as chorea, hyperkinesia, etc. This applies to cases of the disease of Carré that are treated early. When the case is presented some five to 10 days after the first evidence of disease, we still advise homologous serum or use a distemperoid virus but with a more guarded prognosis. At this point in the course of the disease of Carré the so-called secondary invaders are active and show clinical evidence of their presence. The treatment and handling of the secondary infections is the same as that for handling what is often referred to in a general way as mixed bacterial infections. Suggestions for treatment will be given later, to avoid repetition.

Virus infections are essentially intracellular infections. Young cells as found in immature animals and in irritated adult tissues, are especially susceptible to virus invasion. The epithelial cells are most often involved, including the linings of the upper respiratory tract, the entire bronchial system, large and small intestine and the entire urogenital tract. The

*Presented at the annual meeting of the Indiana State Veterinary Medical Association, Indianapolis, January 15-17, 1948.

degree of susceptibility of the animal will vary depending upon its nutritional state and upon the degree of parasitic infections. Certain strains of virus of Carré seem to involve more completely one or another type of epithelium giving rise to the various clinical types of distemper such as the intestinal type, skin type, pulmonary type etc. The virus is the same but varies in virulence and thereby gives rise to variable degrees of secondary bacterial infections. We are of the opinion that the various therapeutic or immunizing agents available carry more or less protection against these types of virus infection. However, in the neurotropic form or nervous type of distemper, where the central nervous system is involved, we doubt that the biologics commonly used carry the same degree of protection. We base this opinion upon clinical observation. Animals inoculated and apparently immune to certain types of virus infection such as the respiratory or gastrointestinal, when exposed to animals afflicted with the so-called nervous form may show no clinical symptoms. Later convulsions, hyperkinesia (chorea) develops. This nervous type is apparently no respecter of age or immunization.

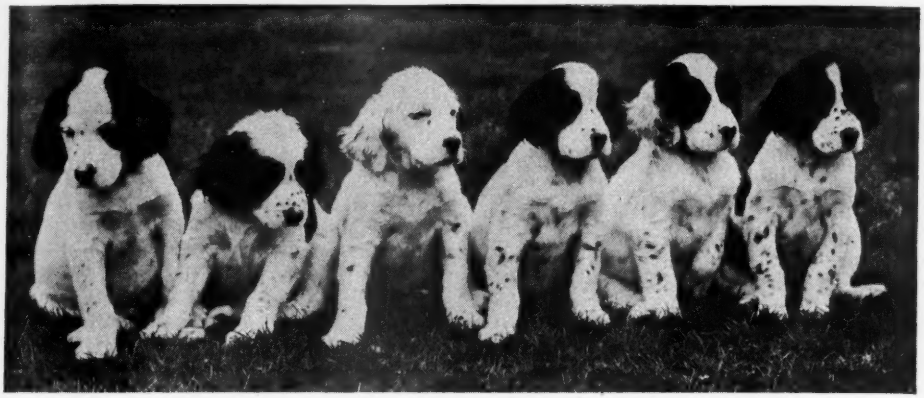
Secondary invading organisms such as the streptococci, staphylococci *Escherichia coli* and bronchisepticus make their appearances after the virus has depressed the resistance of the various mucous membranes or epithelial tissues of the animal. The presence of any of these organisms gives rise to a clinical picture which has been referred to as mixed bacterial infections, infectious catarrhal fever, contagious canine hepatitis, German distemper and disease X. The suggestion is made that a new virus disease is present. I don't know. Laboratory results in so far as I can find, have not sustained this idea. I prefer to think that we are dealing with the same virus of Carré, with possibly a higher degree of virulence than we have generally observed before. This in turn gives rise to a more serious effect of the secondary or mixed bacterial invaders. Animals that have been immunized properly suffer to a lesser degree than those not protected. Animals whose resistance is particularly high or where particular precautions have been taken to avoid bacterial infections, suffer little or none. A classic example is one in which a kennel of Beagles were housed in one building. All were kept on wire. The diet was the same for all. One pen was exposed to ultraviolet irradiation while the rest of the kennel was not. An infection gained entrance to the kennel with the result that all of the dogs in the group exposed to ultraviolet survived while the mortality among the unexposed animals was high. This was a group of all age dogs. To me this indicated that we were dealing with a bacterial infection.

The term "mixed bacterial infections" should be used to apply to those respiratory and intestinal disorders of bacterial origin and as such should be designated as coryza, bronchitis, pneumonia or gastroenteritis. These conditions are contagious and may occur secondary to the disease of Carré or they may be distinct entities. The symptoms are such that it is often difficult to differentiate the one from the other. Age is no barrier to these infections. Parasitism and dietary deficiencies are serious complicating factors. The history of these patients when presented may be that they have been inoculated against distemper when pups. The animal may show a normal temperature of one to two degrees or more of elevation. A cough is observed. The owner may have noted a sudden gastrointestinal involvement, even to the extent of severe, hemorrhagic diarrhea. The appetite is generally poor, but may remain fair. In other instances the owner may present the animal with a history of "off feed" one or two days and today repeated convulsions. In case of gastritis, there is a loss of appetite, increased water intake and vomiting, high temperature —105°F. with dehydration. In either case, whether it be an enteritis or gastritis, the prognosis must be a guarded one, as fatalities are rather common. The symptoms of laryngitis include coughing and possibly vomition. The cough is hoarse and dry in the beginning, but becomes moist and soft later with nausea. Recovery is often slow. Bronchitis may be an extension of coryza and laryngitis or may occur independently, in which case there is a cough, temperature of 103 to 105°F., depression and loss of appetite. It may lead to bronchopneumonia with the general symptoms of elevated temperature, dyspnea etc. On auscultation various sounds may be heard depending upon the amount of exudate and whether coagulation of exudate has taken place. A complete history is necessary in order to diagnose satisfactorily conditions complicated by these secondary infections. This, combined with a careful and thorough examination, will enable one to arrive at a logical line of therapy and to be able to formulate a suitable prognosis.

The treatment of the distemper complex is complicated. It may involve treating animals varying in age from young puppies to aged dogs. Likewise the symptoms may vary from convulsions and chorea to respiratory complications. Since a definite differentiation of the disease of Carré from the mixed bacterial infections is difficult and since we know of no method of immunization that is 100% efficient,

we have adopted a more or less general method of handling all patients. To this we add the specific therapy that may be indicated, during the course of the disease.

When the animal is first examined, we usually decide upon some type of biological therapy. Homologous serum or Green vaccine therapy has been our choice, but is not given in all instances. The dosages have already been mentioned. These biological agents are supplemented with sulfonamide therapy, if the infection is one that involves the larynx, pharynx, tonsils, or the gastrointestinal tract. A preparation that has given us exceptionally good results in treating intestinal disorders is one consisting of bismuth and salol with magma of sulfadiazine 50/50. As it contains sulfadiazine 3.7 grains per teaspoonful. The dose is regulated according to the sulfadiazine content and the weight of the animal. When the infection involves the lung tissue, we prefer penicillin therapy, using dosages from 200,000 to 500,000 units daily, in two doses. We are of the opinion that the doses of this agent that are commonly used are far too small. A 25-pound dog should receive 150,000 to 200,000 units twice a day. If results are not as satisfactory as we think they should be within 36 to 48 hours, we add to the penicillin from 0.25 to 0.5gm of streptomycin. The streptomycin is given only once daily. Such a combination has on several occasions given very gratifying results. Animals that are not eating are given hypodermic injections of therapeutic doses of vitamin B complex. In case of dehydration, intravenous injections of 2.5% dextrose in saline solution are given. Dextrose therapy is employed in animals suffering from dehydration and also showing lung involvement; doses of 25 to 40cc of a 50% solution being given. We consistently administer vitamin A, either hypodermically or in capsules, at the rate of 25,000 to 100,000 units daily to raise the resistance of the animal. In cases requiring stimulation, foreign proteins may be indicated. Our use of the staphylococcic toxoid has been limited. However, we have observed some good results from it. As for the treatment of chorea, I read recently that chorea is curable if proper B therapy be used. Apparently we are not using the proper dose. We find that the use of vitamin B therapy or Fowler's solution may improve the condition but to expect complete recovery is fantastic. Actually, in a final analysis, we cancel far more animals that have chorea than we see live and enjoy life to any extent. As for nervous symptoms other than chorea, massive doses of vitamin B1, penicillin, homologous antibacterial serum and, when absolutely necessary, sedatives, have made up our line of medication. These nervous symptoms may occur at the onset of disease, any time during course of disease or, as we have more commonly observed, may appear 14 to 20 days after apparent recovery. The prognosis of these conditions must be guarded. The mortality rate in our experience has been extremely high.



A chronic tonsillitis may be an aftermath of an involvement of tonsils and tissues of the throat area. If this be true one may expect recurrent acute attacks of tonsillitis, which in our experience can be eliminated only by tonsilectomy.

As to prevention of bacterial infections there are a few general rules to follow:

1. Prevention in hospital: a) Use of homologous serums, bacterins or mixed bacterial serums preferably homologous; b) Avoid drafts, dampness, chilling or faculty circulation; c) Provide good food; d) Keep resistance high by use of vitamin therapy.

2. Prevention at home: a) Good ration; b) Avoid drafts, etc.; c) Provide regular exercise.

It is hoped that I may have offered some helpful information; certainly, I know that I haven't given all the answers.

Pin-Cast Methods for Fractures*

By JOHN L. JONES
Cincinnati, Ohio

DOWN through the years we have seen a gradual evolution and improvement in casts and our methods of applying them. Outstanding practitioners of canine orthopedics, Dibell, Schroeder, Stader, and Ehmer, to name only a few of our contemporaries, have enriched our knowledge and placed in our hands technics and equipment, which enable us to do a better job. Many have hesitated to take advantage of these aids, fearing they are too complicated, too time-consuming or too dangerous. I have employed, as have most of us, many of these technics as they were advanced from time to time, sometimes successfully, at other times with less satisfaction.

It is not my purpose to recommend particular apparatus. However, I should like to suggest that any graduate veterinarian, who can spay a bitch, can also apply a pin cast successfully—either one of those now available commercially or one of his own making. The pin method of applying casts should be routine, and used by all when indicated.

The pin method is practical. In certain types of fractures, it is the easiest and least complicated means of reduction at our disposal. After acquiring familiarity with the application of pins, the time consumed in applying a cast is no greater than by any other procedure that accomplishes the same purpose.

As for danger—yes, there are dangers.

Dangers

1. *Improper sterile technic.*—No elaboration is necessary on this score except to say, that if the pin introduced into the bone is sterile and the area through which it enters the part is prepared carefully, there is little likelihood of introducing infection.

2. *Ascending infection into the bone postoperatively.*—This can be minimized first by providing proper attention to the subject's general condition, thus making him more resistant to infection. Also a light, protective dressing applied over cast and fracture area as necessary will lessen the opportunities for infection. A further safeguard is penicillin and sulfa powder applied around the pin entry points. This is not necessary, but I consider it to be good aftercare.

Before the days of sulfonamide and antibiotic therapy, I saw several bad osteomyelitis conditions as a result of pinning. These were not easily corrected. I believe these cases developed primarily from traumatism of the bone as a result of incomplete immobility of the pins and, secondarily, from infection invading along the course of the pin. These errors resulted from early attempts to use pins in combination with a plaster cast. Had we been a little more ingenious, such consequences would not have happened, I am sure, but after such experiences, we now use sulfa and penicillin powder to seal our pins.

3. *Injury to the operator.*—Under the head of danger, I would mention also the too enthusiastic use of the fluoroscope. In this instance the danger is to the surgeon and his assistants. Over the years I have seen too many men maimed for life as a result of Roentgen ray exposure. Use the x-ray by all means, but take radiographs. It is much safer. When you think you have things right, make an exposure. One will usually be surprised by what the plate indicates has been accomplished.

4. *Failure to approximate segments.*—Another danger, not infrequently seen is where a bone is badly shattered, fractured spirally and splintered. Some of these messes seem to mock one from the x-ray plate, saying: "How are you going to pick up the pieces, muscle tissue, blood vessels, nerves, etc., all tangled up with bone fragments?" We firmly believe that the only safe way to handle such cases is to unscramble the hodgepodge by open reduction, pin up the pieces, and close the incision. In most cases, if careful, aseptic technic has been employed, the incision will heal by first intention in three to five days. Incidentally, in nailing down a wandering fragment two pins should always be used. When fixed by only one pin, a fragment will frequently start rambling again in four or five days. This can be most annoying. If there is any doubt that there may be an important structure between two segments of bone, or any extraneous particle of tissue between them that may not pull back in place upon the application of traction, one should open the fractured area and make certain of the proper placements of the parts.

Typical Procedure in Applying a Pin-Cast

Place the animal under appropriate anesthesia. Prepare the area by surgical clipping. Do not shave. Scrub with soap and water, cleanse with alcohol, dry with ether, place traction on limb, and apply a thin layer of cotton over the entire area and saturate with a suitable antiseptic solution. The antiseptic solution should remain on the parts for about 15 minutes. After the antiseptic layer is removed apply appropriate sterile shrouds. Ordinary

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hand towels serve nicely, if clamped down carefully. The pins may then be applied. Place them in a manner appropriate to accomplish immobilization of the segments. The pins should be placed approximately at an angle of 45 degrees to the bone, with the points just through the surface of the bone opposite to the entry point. When in place the pins should form two sides of an approximate triangle; the base being ready for application of the assembly. From this point sterile procedure is not so important; however, it is well to follow it as closely as possible. When inserting the pins through skin, it should be pushed toward point of pins' entry, to lessen skin tension when the fracture is reduced. When applying the assembly, put slight upward tension on the pins and fix. This will aid in holding pins more solidly in place. Apply the adjuster assembly to the pin assemblies and employ more traction. After several minutes, the muscles will relax and still more traction may then be applied, until the segments are in approximate alignment. When this is accomplished such lateral anterior-posterior adjustments as may be necessary may be made. Then fix the immobilizing bar between the two pin assemblies, remove the adjuster assembly.

Compound Fractures

Needless to say, sometimes it becomes necessary, in compound fractures, to defer pinning for several days, until some of the swelling has receded and the tissues of the part have almost regained their normal appearance and tone. A temporary immobilizing cast should be applied until pinning can be accomplished.

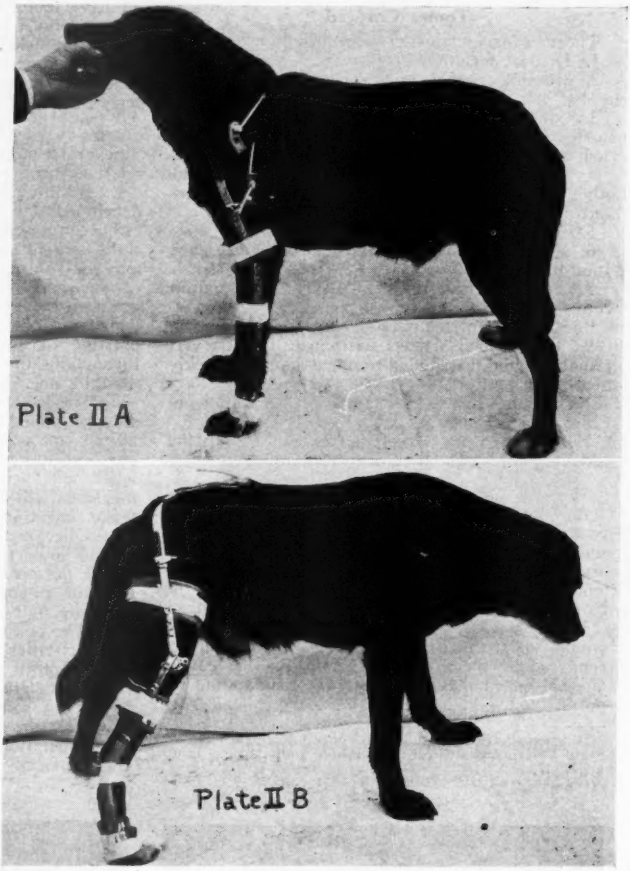
Aftercare

The subject should be closely confined in an area where the cast cannot become entangled with some projecting object. Cast and dressing should be inspected daily, particular care being taken to see that nuts and pins do not become loosened.

This sometimes happens with unfortunate results. If the pinned areas should show the slightest indication of infection, a course of penicillin and sulfonamide therapy for three to five days will usually quiet any incipient trouble. From time to time, as the judgment of the surgeon dictates, an x-ray plate should be made, to follow the course of healing.

Summary

1. The pin casts where indicated, are simple to apply and practical.



One of the early pin methods of reducing fractures and fixing fractured portions in alignment. This method was demonstrated by Dr. R. A. Self in 1934.

2. The pin cast is not more time-consuming to apply than any other, after one has become familiar with the procedure.

3. The pin method may be dangerous, but so is any other method if improperly accomplished.

4. Any veterinarian, who can follow the sterile process necessary in an uncomplicated oophorohysterectomy in a bitch, can most certainly observe the necessary sterile procedure in applying a pin cast.

Report of Public Relations Counsel, Indiana V.M.A.*

This report covers 10 months of public relations activity, starting March 1, 1947. During that period a total of 1,012 stories appeared in 219 Indiana newspapers. The number of column inches were approximately 4,980. At advertising rates they would have cost the association $3600 beside the cost of collecting, preparing and distributing.

Topics Covered

The newspaper coverage included:

1. District meetings.
2. Meetings of directors and officers in Indianapolis.
3. Committee appointments, on which individual stories were sent to home town newspapers of each appointee, some 75 in all.
4. Special stories for the United Press and other wire services on the new brucellosis law and on the rabies situation.
5. Radio talks by members.
6. Ohio State University annual conference June 10-13.
7. American Veterinary Medical Association convention in Cincinnati.
8. Purdue short course October 1-3, 1947.
9. Two special articles written by Indiana veterinarians and distributed to more than 200 weekly newspapers.
10. U. S. Livestock Sanitary Association in Chicago, December 3-5.
11. Formulating a reply to an editorial in the Indianapolis News on rabies vaccination.

District Meetings

Advance and follow-up coverage during the year were given for virtually all meetings of the eight district associations in the state; assisted in organizing the Central Indiana V.M.A. and attended the Wabash Valley, the Northeastern, the Northwestern, and the Indiana-Illinois meetings.

In every case, facts were brought out which would tend to inform the public as to the service rendered by the profession. This type of coverage was used throughout, rather than outine reports.

Special activities were stressed, such as the Northeast Association's radio program.

Stories of widespread general interest were given to the wire services at the same time as to the local papers. Brucellosis and rabies are the two subjects which interest the editors most. They are also the subjects which can be used most effectively in carrying out our objective to make clear to the public that the veterinarian is a guardian of the public health.

Remarks

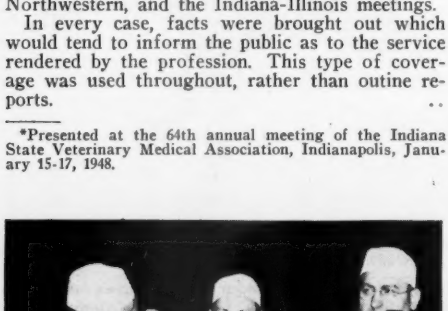
I have found the newspapers most receptive to this material. Several editors contacted personally or by telephone thanked me and asked for more. Newspapers are not resistant to material which will interest their reades and which is properly presented in a form ready to use.

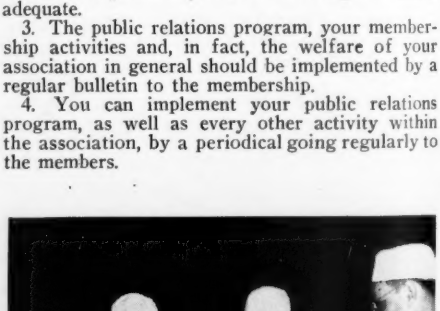
Recommendations

Several things can be done to make the public relations program even more effective.

1. Additional news-creating activities can be developed. I would like to see an effective speakes bureau developed to fill requests from luncheon clubs, parent-teacher associations, etc. Looking into the future, it is my opinion that the training of such speakers would be a far-sighted program, designed to help all meet tougher days which may be ahead, and designed to build the prestige of the profession steadily and surely throughout the years. The veterinary story is a thrilling one. Why not tell it?
2. The process of gathering the news should be speeded up. At this point, while long range activities are developing, the district meetings are our best source of public information. And even when new activities are developed, the district meetings will always remain a focal point of interest and a source of continuous publicity. But a speedier method of gathering the information should be perfected. We can do this by telephone. if one person can be obtained in each district to take the responsibility and if the budget is made adequate.
3. The public relations program, your membership activities and, in fact, the welfare of your association in general should be implemented by a regular bulletin to the membership.
4. You can implement your public relations program, as well as every other activity within the association, by a periodical going regularly to the members.

*Presented at the 64th annual meeting of the Indiana State Veterinary Medical Association, Indianapolis, January 15-17, 1948.





Views in the clinic at the 57th annual meeting of the Indiana V.M.A.. At the left: H. J. Magrane, Mishawaka, H. Meade Hamilton, Muncie, and E. K. Sales, East Lansing, Mich. Continuing to the right: Paul T. White, Indianapolis, and Magrane, Sales and Hamilton.

Preliminary Report on the Propagation of Avian Pneumoencephalitis Virus (Newcastle Disease) in Vitro

By R. A. BANKOWSKI, D.V.M., and W. H. BOYNTON, D.V.M.*
Berkeley, California

THE virus of pneumoencephalitis (Newcastle disease) can be propagated with relative ease in chicken embryos. However, since the embryo fluids in which the virus is found are not always adaptable to specific studies, a method of cultivating the virus in a less complex medium would be highly desirable.

Artificial cultivation of pneumoencephalitis virus was accomplished with essentially the same modification of Simms-Sanders[1] medium which Boynton employed for the propagation of hog cholera virus.[2] This medium is in brief a combination of serum ultrafiltrate and physiological solutions containing fresh tissue. For cultivating the pneumoencephalitis virus, bovine and chicken sera were used in place of swine serum for the ultrafiltrate, and livers and hearts of 10 to 13-day-old embryos were substituted for the bone marrow of swine, which furnished the tissue in Boynton's modification. With this technic, any desired amount of clear, tissue-free fluid containing the virus, is easily obtained. The initial inoculum consisted of finely chopped livers of two embryos showing subnormal vigor following inoculation 36 hours previously with California Strain 11914 of pneumoencephalitis virus. This strain shows a marked hemagglutinative activity and has a wide distribution among laboratories of the United States where it is employed in experimental and diagnostic work. The tissue cultures in the modified Simms-Sanders media containing bovine serum ultrafiltrate were incubated at 37°C. for 72 hours and kept for 24 hours longer at room temperature. The supernatant fluids were then harvested and stored at ice box temperature (9°C.). The series has been carried along so for 10 generations.

A second series of cultures was begun, employing the same procedure and materials except that the ultrafiltrates used in the medium were prepared from chicken rather than bovine serums. The initial inoculum of the second series consisted of 0.5ml of the 5th generation virus culture in bovine ultrafiltrate media. Thereafter, the two series of cultures were concurrent.

Propagation of the virus in either the bovine or chicken ultrafiltrate medium was followed by certain significant changes in its characteristics. The tissue culture viruses failed to agglutinate chicken red blood cells after their first passage. The cultures, however, retained their virulence for embryos, and the amnio-

Vineland Poultry Laboratories

Severe cases of pneumoencephalitis

allantoic fluids of the dead embryos agglutinated chicken red blood cells.

Viability tests were conducted on each generation of tissue culture by intramuscular inoculation of each of two chickens with 0.5ml quantities and by titration of the cultures on embryonating eggs (Table I).

The virus propagated in bovine ultrafiltrates showed a tendency towards modification of its virulence for chickens. Birds inoculated with cultures containing virus of the first three generations died with typical symptoms and lesions of the disease. Of 14 chickens inoculated with the 4th to the 10th generation of tissue culture, 10 failed to develop any symptoms following inoculation with cultures having an embryo titer of 10^{-4} to 10^{-7}. Hemagglutination-inhibition[3] (HI) antibodies were demon-

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The authors wish to extend their gratitude for the fine technical assistance rendered by Charlotte M. Frunk, Ruth E. Johnson and Mary Edwards Porter.

strated in the blood of the chickens, although the HI titers were below those expected after inoculation with a live egg-propagated strain of PE virus. All of the birds were refractory to a challenge dose of 200,000 chicken M.I.D. of PE virus. The virus cultured in chicken ultrafiltrate medium did not show as strong a tendency towards modification in its virulence for chickens.

The embryo titers determined by inoculation of embryonating eggs with serial dilutions of the tissue cultures, fluctuated considerably; however, titers of 10^{-5} or 10^{-6} were obtained with some degree of regularity. Contamination of the cultures markedly influenced the viability of the virus. This is contrary to Topacio's experience. He reported on the cultivation of avian peste virus in Tyrodes solution and stated that a certain amount of contamination did not seem to interfere with the viability and multiplication of the active agent. Other factors which affected the propagation of the virus were filtration of the culture through a Corning bacterial filter, incubation time, and storage periods between transfers.

Further studies on propagation of PE virus by this method are in progress.

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TABLE I.—EFFECT OF ARTIFICIAL CULTIVATION OF PNEUMOENCEPHALITIS VIRUS UPON ITS HEMAGGLUTINATIVE ACTIVITY AND INFECTIVITY FOR EMBRYONATING EGGS AND CHICKENS

	Passage No.	Days Stored Between Passages	HA[1] of Culture	Embryo Titer	Inoc. of each of two chickens IM with 0.5ml of culture: Results[2]	HI Test: Day	HI Test: Titer
BOVINE ULTRAFILTRATE MEDIUM	Initial	—	0	—	2 positive	—	—
	1	5	0	—	2 positive	—	—
	2	5	0	—	1 negative	9	320 or >
					1 positive	—	—
	3	18	0	10^{-3}	2 positive	—	—
	4	5	0	10^{-5}	1 negative	8	80
					1 negative		320 or >
	5[3]	172	0	10^{-5} or >	1 negative	9	20
					1 negative		40
	6	7	0	10^{-5}	2 negative	7	80
	7	5	0	10^{-6}	1 negative	10	320
					1 positive	—	—
	8	8	0	10^{-4}	1 negative	10	40
					1 negative		80
	9	4	0	10^{-6}	2 positive	—	—
	10	8	0	10^{-7} or >	1 positive		—
					1 negative	10	20
CHICKEN ULTRAFILTRATE MEDIUM	6	3	0	10^{-4}		—	—
	7	2	0	10^{-5}		—	—
	8[4]	4	0	10^{-2}	2 positive	—	—
	9	5	0	10^{-7}	2 positive	—	—
	10	6	0	10^{-5}	1 positive	—	—
					1 negative	12	80
							80
	11	8	0	10^{-5}	2 negative	10	320

[1]HA—Hemagglutination of chicken red blood cells.
[2]Positive—Susceptible to inoculum with symptoms, death, and typical lesions of pneumoencephalitis.
Negative—No symptoms of disease in 12 to 15 days and refractory to a challenge dose of 200,000 chicken mid of PE virus.
[3]Embryo titer of passage No. 4 10^{-5} or greater immediately following harvesting. After 172 days storage at 9°C. the titer decreased to 10^{-1}.
[4]Culture incubated for 48 hours at 37°C.

Veterinary Problems in Poultry Production

By W. R. HINSHAW, D.V.M., Ph.D., Davis California

In the February, 1948, issue of VETERINARY MEDICINE the writer discussed a plan for genetic control of avian lymphomatosis as suggested by Hutt and Cole. The success of such a plan depends on the ability of stock, resistant under a given environment, to maintain that resistance when exposed to the disease in another environment. DeOme *(Poultry Sci.,* 22:381, 1943) demonstrated that the percentage mortality from the disease is influenced by the level of exposure. He showed that even in highly resistant strains, the incidence increased as the level of exposure increased. This may account for unexplained losses from the disease in chickens purchased from hatcheries that have highly resistant strains, as tested under a particular local environment, when exposed to a higher level of infection in a new environment. The possibility of multiple strains of the causative agent may also account for increased losses from the disease when chicks are shipped from one area to another. If more than one strain exists it would be possible for chicks from parent stock resistant to one strain to be very susceptible to a strain in another area.

* * * *

Hexamitiasis, disease of poults from one to 10 weeks of age is caused by a protozoan parasite, *Hexamita meleagridis.* In the early stages of acute outbreaks the poults are nervous, require additional heat, the body temperature is usually subnormal, the gait is stilted, and the feathers ruffled and unkempt. There is a characteristic foamy, watery diarrhea.

At autopsy the birds are in poor condition, the skin is dry, and the flesh of the breast is dehydrated and reddened. The principal pathology occurs in the upper intestine, where there is catarrhal inflammation with marked lack of tone. A definite diagnosis can be made only by the demonstration of the parasites in the upper intestine. Examination of cecal contents for the presence of these parasites is not recommended, because of possible confusion with other flagellates.

No satisfactory remedy for hexamitiasis has been found. Every effort should be made to keep breeding and brooding operations apart since the principal means of transmission is from the adult carrier to the poult. Pheasants, quail, peafowl, and chukar partridges may also be carriers. Sanitation and management play important parts in preventing the disease. Increasing the temperature of the brooder in case of an outbreak will aid in reducing mortality, as will every effort to keep them eating.

The toxicity of linseed meal for chicks has been demonstrated by several research workers. It has now been shown that this toxic principle of linseed meal can be destroyed by a simple water treatment. (Kratzer, F. H., *Poultry Science* 26:90, 1947; and MacGregor, H. I., and McGinnis, J., *Poultry Science* 27:141, 1948.) The addition of water treated linseed meal at 30% of an "adequate" diet had no ill effect on chicks. Recent work by Kratzer and Williams (*Poultry Science,* 27:236, 1948) suggests that linseed meal is toxic because, when eaten, it produces a deficiency of one or more of the B-complex vitamins, possibly by the formation of a compound with the vitamin which renders it unavailable.

The usual method of treating linseed meal to destroy the toxic factor is to mix the meal with 2.5 times its weight of water, and allow the mixture to stand at 25° C. for 18 hours. The mixture is then dried at about 70° C.

Trichomoniasis in Poultry

The *Trichomonas gallinae* is a pathogenic, perhaps the only pathogenic, trichomonad of birds. The columbid birds (pigeon, dove) are the natural hosts of this parasite but it causes disease less frequently in all barnyard fowl and in a wide variety of wild birds. Probably pigeons are responsible for the infection of domestic birds through contamination of the drinking water.

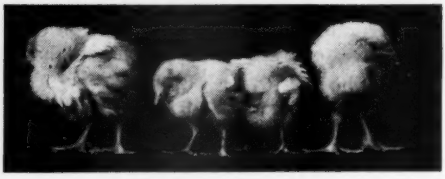
T. gallinae has many synonyms—*T. hepatica, T. columbae, T. diversa, T. halli.* It was first described by Rivolta in 1878. Its normal habitat is the upper digestive tract, seldom below the gizzard. Its lesions commonly consist of small areas usually termed canker spots in the crop, esophagus, pharynx, mouth, and head sinuses. In severe and fatal attacks of trichomoniasis these areas enlarge and coalesce to form great lumps of caseated detritus. The organisms permeate the walls of the upper digestive tract and all tissues of the body, even the brain, may contain the cheesy masses characteristic of it.

Many birds harbor the parasite without evident harm, but disease outbreaks in which the mortality is high, occur, at times, in all species.

Coccidiosis in young chicks is next in importance to pullorum disease. It is a filth-borne disease. The "6 C" program, clean chicks, clean ground, clean brooder houses, clean litter, clean feed, and clean management, if followed to the letter, will be found to have a very important part in the general health condition when the pullets are ready to house. It is not difficult to make a diagnosis of coccidiosis in chickens. Formerly one depended on the evidence of bloody droppings; such is not the case today. There are many types of the disease recognized, but bloody droppings are found only in the cecal type. The symptoms of coccidiosis are: A large percentage of the flock attacked at the same time, ruffled feathers, great depression. At autopsy extensive tissue destruction is found in the intestinal tract.—F. C. TUCKER.

Controlling Pullorum Disease

When principles of poultry sanitation are neglected, many disease problems will be encountered. A thorough knowledge of poultry diseases and poultry husbandry enables the veterinarian, who plays an important role in



Pullorum in young chicks

the production of viable chicks, to render service that will be highly appreciated.

Pullorum disease is the most fatal poultry disease. Short interval retesting until all reactors are eliminated, will assure viability of baby chicks. In the efforts to control pullorum disease, one should not lose sight of the fact that not all of the infected chicks die of the disease. Up to 25 to 50% of the infected chicks may survive an attack and become carriers.

If the future crop of baby chicks is to be considered, the carrier hen must receive increased attention. The pullorum organism which originally lives in the blood stream of baby chicks, localizes most commonly in the reproductive organs, remaining there as a focal infection. Preventing the eggs of carrier flocks from getting into the incubators is the only known means of successfully controlling this disease. The tube agglutination test is a very reliable method of locating these infected flocks. It is with the "disease eradication minded" hatcherymen that veterinarians can make rapid forward strides in the control of pullorum disease; as one of them phrased it: "blood testing is to the poultry industry what spraying is to the fruit grower."

There is considerable work attached to this method of testing, and it involves considerable

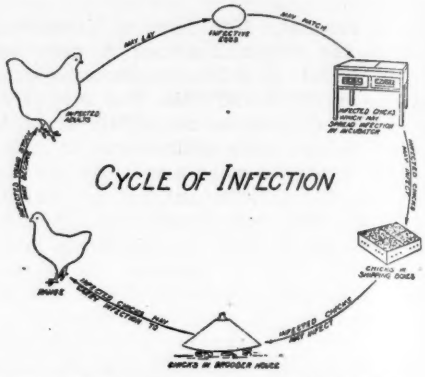


Fig. 1. Pullorum disease infection in a flock may follow this cycle. The disease can be eradicated either by breaking the cycle of infection through eliminating the infected birds by means of the agglutination test, or by disposing of the entire infected flock and replacing it with pullorum disease-free stock.

outlay for laboratory equipment. In addition to tube testing the flock owner should be advised to improve, where possible, the sanitary and hygienic conditions, to provide plenty of fresh air and fresh clean drinking water.—F. C. TUCKER.

Rous, 35 years ago, discovered that malignant tumors in chickens could be propagated by cell-free filtrates. The Rous sarcoma has all the characteristics of a malignant tumor: it cannot be transplanted to other varieties of birds; it is not infectious to other chickens even on close contact; it grows and forms metastases like other sarcomata and it retains the morphologic characteristics of a spindle-cell or small cell sarcoma, osteochondrosarcoma, or endothelioma.—*Am. Rev. Soviet Med.*

Chicken pox is a disease that can well be prevented by vaccination of the young birds from one to three months of age, and while they are still on the range, or at least one month before they are put into the laying house. If there has been no pox on the farm, and none in the community, vaccination is not recommended. It is advisable only if there is a likelihood of an outbreak. Pox is a skin disease, spread by contact or by insect carriers. Pullets in the laying house should not be vaccinated, unless there is grave danger of an outbreak.—F. C. TUCKER.

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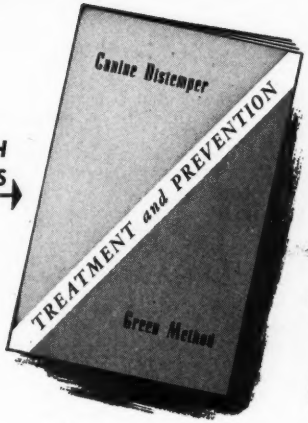

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You'll Be Interested to Know That . . .

Are the Men Cannibals!

In a recent report by the New York Food Commission it was discovered, among other things, that men eat more eggs than women.—*Poultry Digest* (May, 1948).

■

"Touring with Towser," a directory of hotels and tourist courts that accommodate guests with dogs, has been issued by the Gaines Dog Research Center. Persons desiring a copy of this directory may secure it by writing the Center at 250 Park Ave., New York 17.

■

New Water Trough De-icer

The new heating device—a watering trough de-icer—which floats and keeps livestock drinking tanks free of freeze-overs all winter long is now available from Westinghouse Electric Corporation.

■

Pitman-Moore Company, Division of Allied Laboratories, Inc., has purchased a 160-acre farm to be used for research on veterinary pharmaceutical products for large animals under actual field conditions. The property is located a short distance south of the company's Biological Laboratories near Zionville, Indiana.

■

Elected for Second Year

Clarence M. Olson

For the second consecutive year Clarence M. Olson, manager of the Pard Dept. of Swift & Company, and well known in dog circles, was reelected president of Dog Week and will preside over the activities of National Dog Week.

The Boy Scouts, the Girl Scouts and the Camp Fire Girls will take an active part this year, as they have in the past, in promoting community observance of Dog Week.

■

Attendance at annual convention of the American Animal Hospital Association is reported to have approximated 500. Officers elected are Harold Groth, San Mateo, California, president; J. Stuart Crawford, New Hyde Park, New York, 1st vice president; Ralph E. Ruggles, Moline, Illinois, 2nd vice president; Wayne H. Riser, Evanston, Illinois, executive secretary; Arthur R. Theobald, Cincinnati, Ohio, treasurer, and Jerry L. Ruble, Orlando, Florida, member of the executive board. The 1949 annual convention will be held in Toledo, Ohio.

On May 1, Eugene W. Harrington, president of Sterling Research Corporation, Buffalo, N. Y., presented an award of merit, given annually by his company, to the manager of Arcade Farms Cooperative, Inc., Blasdell, N. Y. In placing this award several thousand milk companies in the United States were considered and the one which contributed most, during 1947, to the early detection of mastitis in milk cows, was given the trophy.

■

Arnold Laboratories Announce New Labels for Pharmaceutical Products

In announcing complete new labeling for the firm's pharmaceutical products, Dr. J. J. Arnold, President of Arnold Laboratories, stated that he believed that labels should give the veterinarian all the information necessary for proper administration. Too many times they fail to include complete data on contents, dosage and directions for use which might be needed quickly, particularly in emergencies.

The company's new labels will enable the veterinarian to know exactly how to prescribe and dispense their products. An interesting feature is the "tear-off" labels for dispensing pharmaceuticals.

■

An Extensive Campaign to Benefit Veterinarians

A new series of public relations articles and cartoons telling the story of animal health and the veterinary profession has just been issued to newpapers, coast to coast, by Associated Serum Producers as a part of its continuing campaign of public education.

The release comprises 12 columns of feature articles and interesting pictures. More than 2,600 newspapers are receiving the material for release during spring and summer months. The illustrated articles, titled "Health Hints for Livestock," are issued over the name of the American Foundation for Animal Health. They take up such subjects as baby pig disease, calf problems, brucellosis, foot-and-mouth disease, bovine tuberculosis, hog cholera, cowpox, disease carriers in poultry flocks, anthrax, and other timely topics. In each case, animal owners are warned of these disease dangers and the articles bring out the importance of relying on the veterinarian for diagnosis and proper treatment.

The cartoon features, in dramatic form, call attention to current disease problems, recent veterinary research discoveries and the part the veterinary profession is playing in helping to save livestock losses and increase the farmer's profits.

This illustrated service to newspapers is an added feature of the year 'round public relations program on behalf of the veterinary profession now being conducted by Associated Serum Producers. Other phases of the campaign include general news releases, radio releases, a series of educational messages, "What the Veterinary Profession Means to Mankind," in leading farm journals, a special drive on hog cholera immunization in hog raising states, timely articles to farm publications, and the new motion picture, "Valiant Years," which has been released for public showings throughout the nation.